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MECCANO MAGAZINE

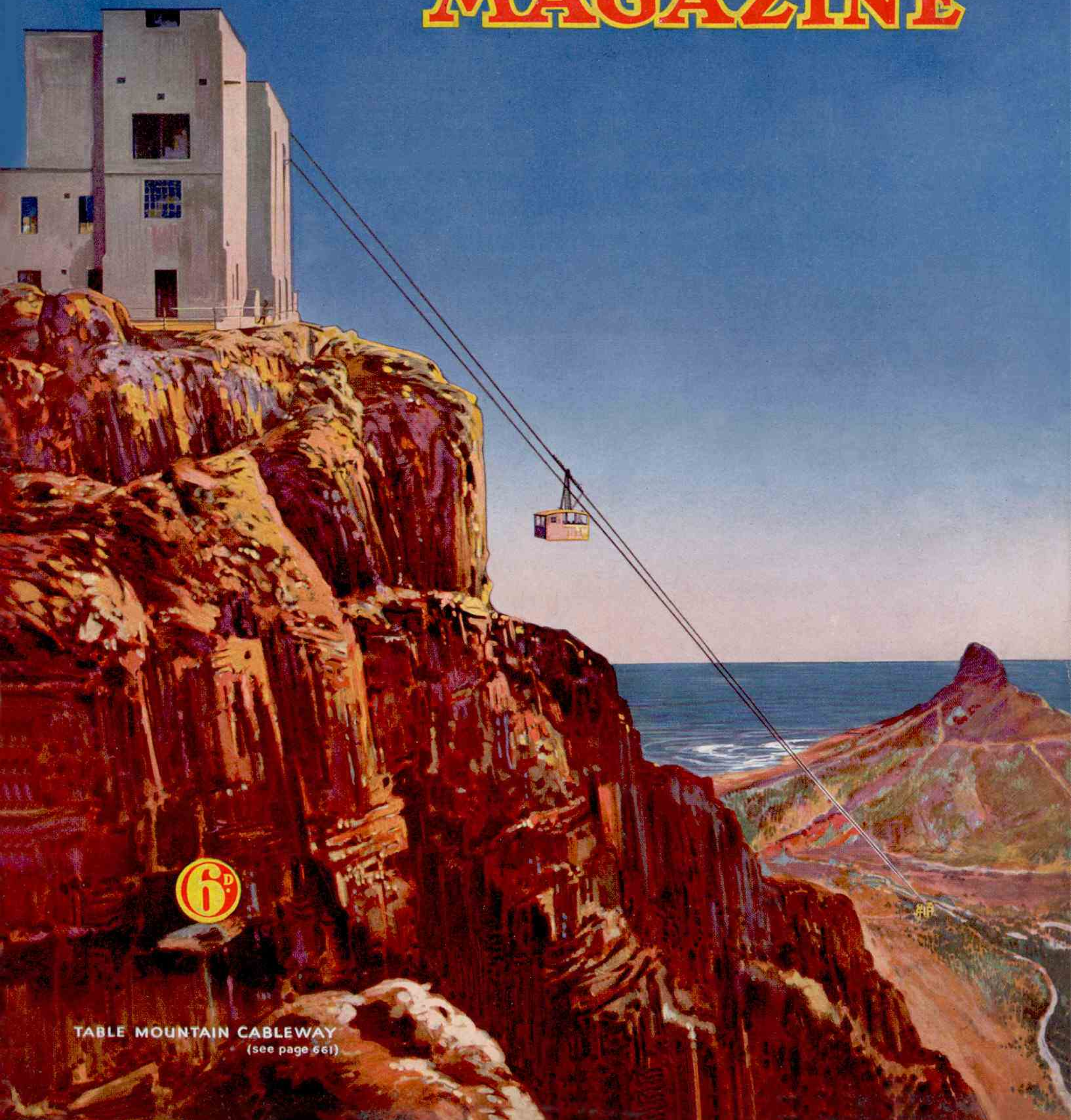

TABLE MOUNTAIN CABLEWAY

(see page 661)

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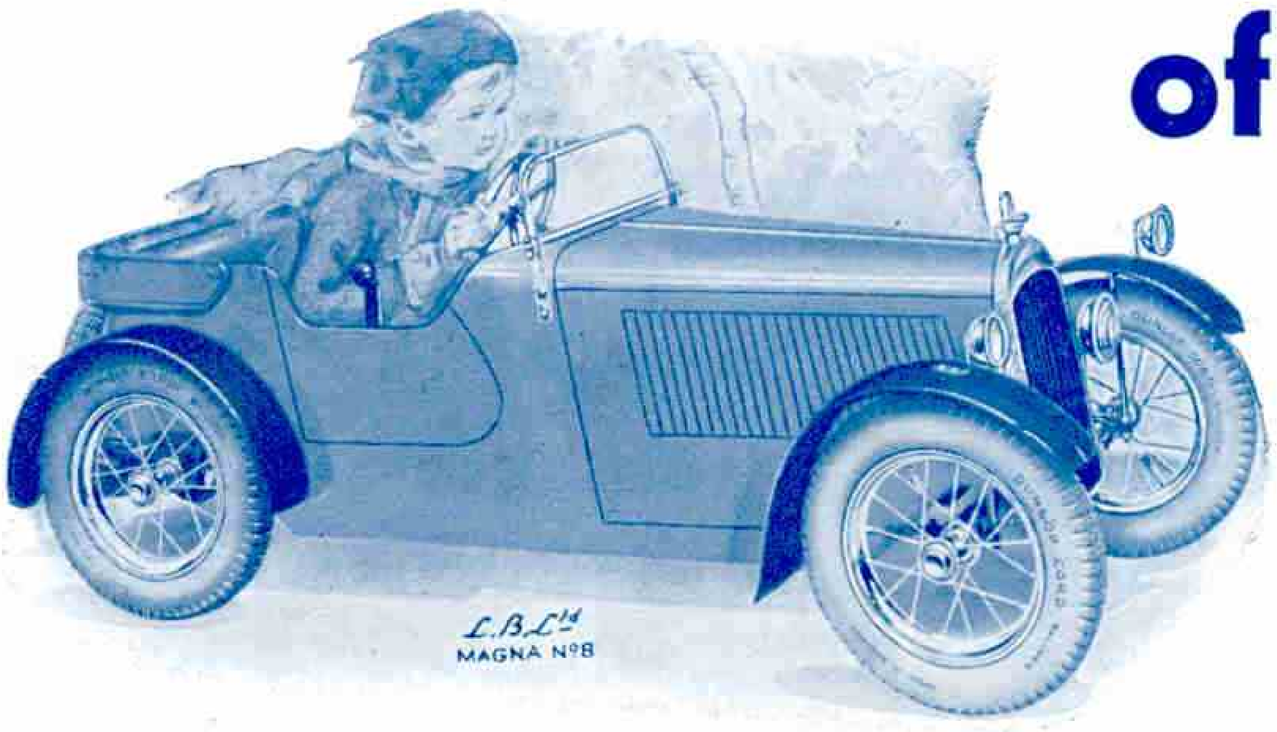

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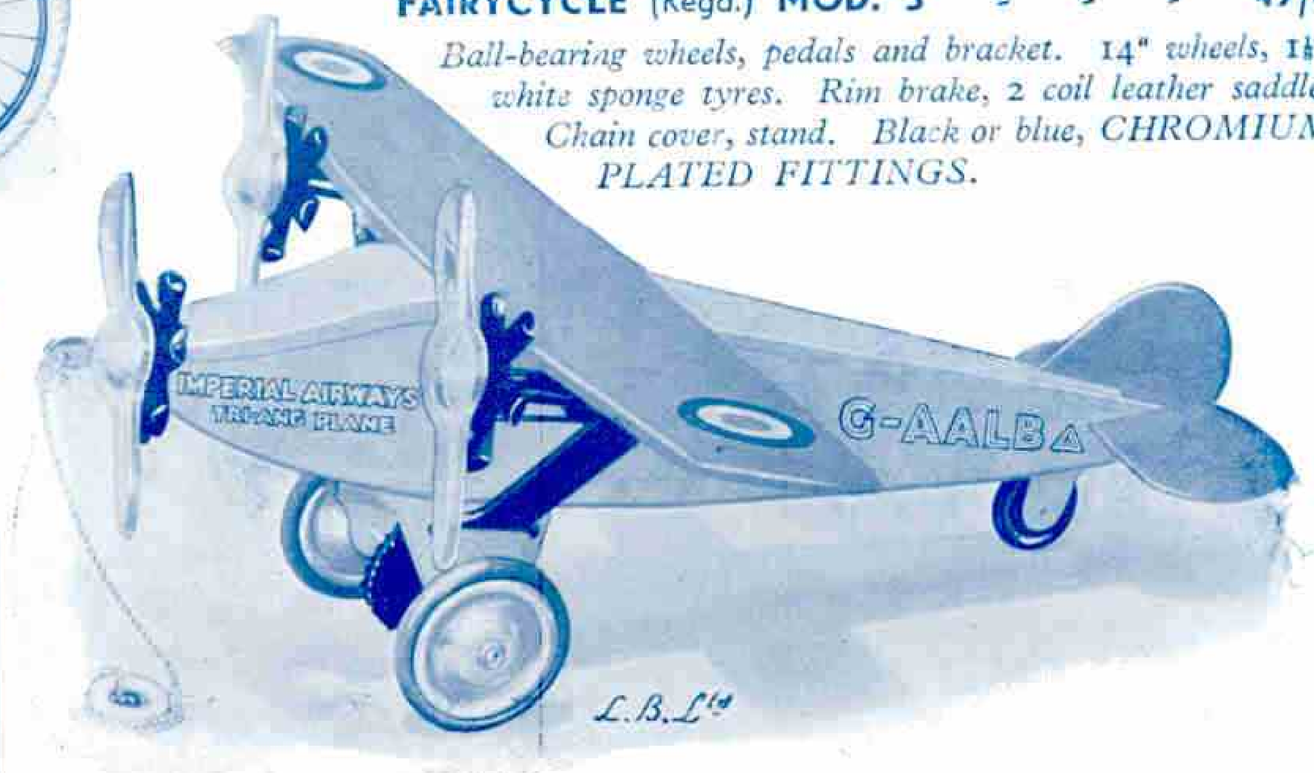

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NEXT MONTH: "THE SLEUTH-HOUNDS OF THE NAVY." PUBLISHING DATE: 1st OCTOBER

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With the Editor

A Pioneer of Aviation

By the death on the 24th July last of M. Santos-Dumont, the world has lost one of the most romantic figures in the story of the conquest of the air. Unlike most pioneers of aviation, Santos-Dumont was directly interested in every type of aircraft. He began his career by making ascents in free balloons of the usual spherical shape, and he fitted several of these with small motors in the hope that by this means he would be able to control their flight. These experiments were unsuccessful, but they led him to the construction of cigar-shaped vessels fitted with propellers driven by motors, and with elevators and rudders. In these airships he had many remarkable adventures and escapes from death. Finally he turned his attention to aeroplanes.

Santos-Dumont was born at São Paulo, Brazil, in 1873, and was the son of a wealthy coffee grower. During 1897 he came to Europe, and at Paris he made an ascent in an ordinary balloon. The experience so thrilled him that he became an ardent balloon enthusiast and ordered two balloons to be constructed for his own use. One of these was called "*Brazil*," and was so small that he was able to carry it about in his portmanteau. This balloon was of 4,104 cu. ft. capacity, and when inflated had a lifting power of about 180 lb. The other balloon could accommodate five persons, and was named "*Vaugirard*."

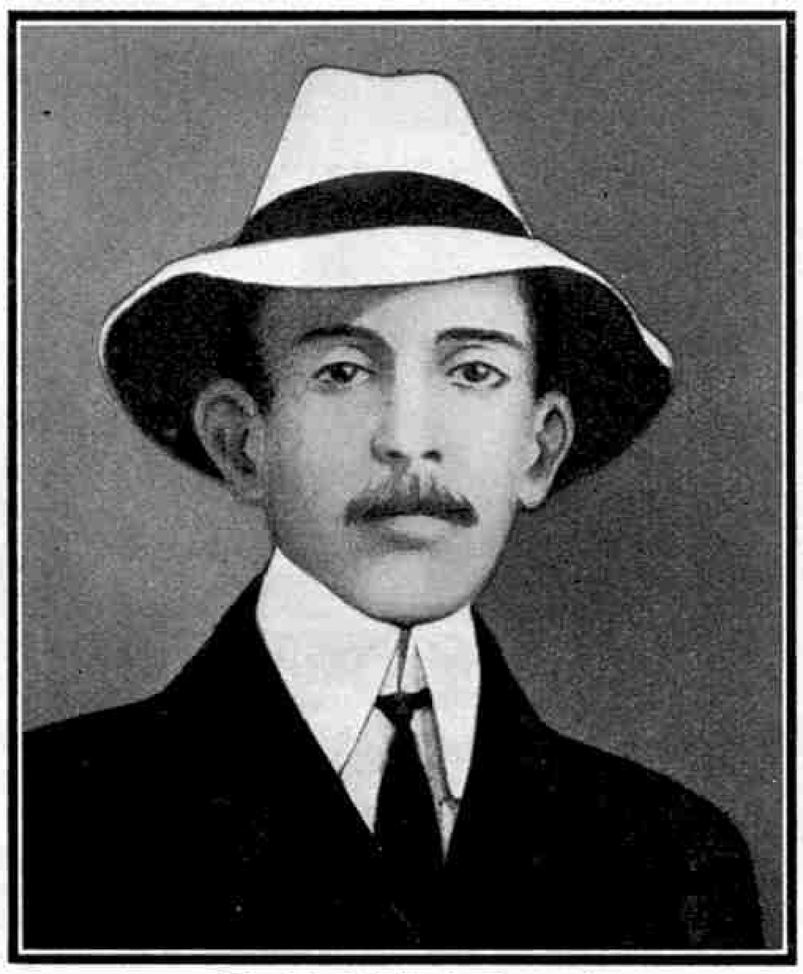
Motor tricycles were very popular at that time, and one day it occurred to Santos-Dumont that by applying the motive power of a tricycle engine to a balloon he could evolve an effective airship. In a workshop in the Rue du Colisee, Paris, he adapted the motor of a tricycle for this purpose, and, as he said, "realised something that was interesting in those days—a 3½ horse-power motor that weighed 66 lb." The envelope for the dirigible was constructed to his plans and was cylindrical in shape with cone-shaped ends. It was made of Japanese silk, and was 82½ ft. in length, 11½ ft. in diameter and of 6,354 cu. ft. capacity. A small car was suspended beneath the envelope, and a rudder consisting of a triangular steel frame covered with silk was attached to the stern. The airship was named "*Santos-Dumont No. 1*," and two short trial flights were made in September 1898, from the captive balloon station at the Paris Zoological Gardens.

Early in the following year Santos-Dumont constructed his second and larger dirigible, with a gas capacity of 7,000 cu. ft. The trial flight was carried out from the same place as the tests of the first airship, but a rainstorm caused the gas in the envelope to contract so much that the airship fell rapidly and was wrecked in the topmost branches of some high trees.

Other airships followed, the fourth, completed in September 1900, being equipped with a two-bladed propeller at the front end instead of at the stern. It was operated by a 7 h.p. twin-cylinder motor at the rate of 100 r.p.m., and it made several successful flights over Paris.

The two-cylinder motor was later replaced by a four-cylinder one, the airship envelope being increased in size to compensate for the added weight. The improved vessel was so successful in flight that with it Santos-Dumont attempted to win a prize of £4,000 offered to the first man who should succeed in making an aerial flight round the Eiffel Tower. His attempt ended in disaster, however, but he accomplished the feat on 19th October 1901, with his sixth airship, which was of 22,239 cu. ft. capacity and had a lifting power of 1,518 lb.

For a time Santos-Dumont was interested in the subject of heavier-than-air machines, and on 12th November 1906, he carried out a brief but successful flight at Bagatelle, near Paris, in a machine of his own construction. The machine rose to a height of about 15 ft. and flew about 700 ft. through the air in 21 seconds.



The late M. Santos-Dumont.

Canada's Wonder Canal

The Great Lakes of North America and the short rivers and canals connecting them form with the St. Lawrence the world's most wonderful inland waterway. The distance from the Strait of Belle Isle at the mouth of the St. Lawrence to the western end of Lake Superior is 2,339 miles, but when white men first settled in North America, and for many years afterwards, the waterway was not navigable over its entire length, Niagara Falls, and rapids in the St. Lawrence itself and elsewhere, being serious obstacles. A little more than 100 years ago steps were taken to circumvent these obstacles by means of canals, which at first were narrow and shallow, but were increased in width and depth from time to time in efforts to cope with the increasing traffic. The size of the successive canals is indeed a measure of Canadian progress, for as the population of the country increased, and its industries grew in importance, they were called upon to give passage to larger vessels.

The gréatest of the artificial waterways that form the connecting links of the Great Lakes system is the reconstructed Welland Ship Canal, which connects Lakes Erie and Ontario, and was officially opened last month. This canal is 25 miles in length and 30 ft. in depth, and is remarkable for the magnificence of the locks by means of which vessels passing through it ascend or descend the steep slope of the Niagara escarpment. There are seven of these structures, each giving a lift of 46 ft. 6 in., in addition to a guard lock 1,380 ft. in length that is the longest lock in the world.

The construction of the great locks and the completion of the Canal itself are triumphs of modern engineering, for it was necessary to make long portions of the existing canal wider and deeper, and to unite new sections to them, without hindrance to vessels using the old waterway or to traffic on the busy roads and railways crossing it. How this was done will be fully explained in interesting articles to be commenced in an early issue of the "*M.M.*"

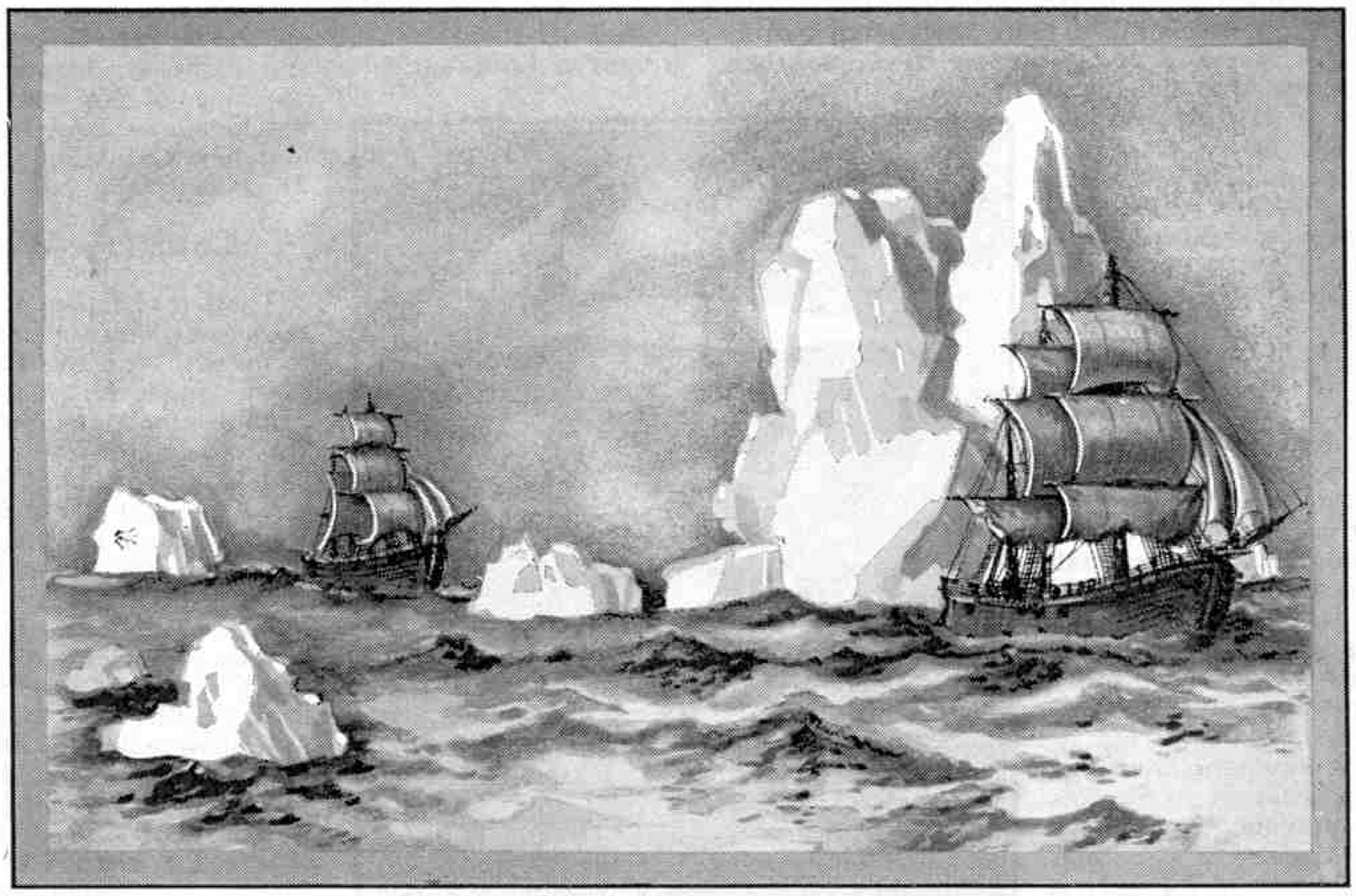
Other obstacles remain to be overcome before there is deep-water communication between the Great Lakes and the Atlantic Ocean, for at present some of the canals by means of which the rapids of the St. Lawrence are avoided are only 14 ft. in depth. Canada and the United States have agreed to work together in providing a waterway 27 ft. in depth between Lake Ontario and Montreal, however, and the engineering work involved will include hydro-electric power schemes developing the gigantic total of 5,000,000 h.p.

The Romance of Whaling

I.—Different Types of the Sea Monsters

WHALING is one of the oldest and most romantic occupations of the sea, and its history is full of thrilling stories of adventure in which courage, daring and skilful seamanship have played a great part. The development of powerful mechanical weapons has done much to rob whaling of its romance, and modern whaling is a cold-blooded, scientific business that bears very little resemblance to the methods of even a century ago. In this series of articles we shall follow the changing fortunes of the whaling industry from its earliest days to the present time. Before starting upon this most interesting story, however, it will be well to familiarise ourselves with the chief species of whales and the purposes for which they have been and are ruthlessly hunted.

The business of whaling is often spoken of as "whale fishing," but more generally and accurately as "whale hunting." This is logical, for whales are not fish, but sea-dwelling warm-blooded animals which, millions of years ago, lived on the land, crawling about the vast swamps that covered much of the earth's surface. All external trace of their association with life on land disappeared long before whaling began, and to-day only small bones in the shoulder and tail remain as evidence of the fore and hind legs possessed long ago.



Hunting for whales amid the Arctic ice, in the days of the sailing ship.

Whales are classed under two headings, whalebone whales and toothed whales. Each class includes several species, and each of these possesses different characteristics and habits. The principal species of the whalebone class are the Right Whale, the Black Whale or Nordcaper, and the Rorqual or Finner Whale. The best known of the Right Whales is the Greenland Whale, an ugly-looking animal with an enormous mouth in which a huge whalebone, called the baleen, takes the place of teeth. The baleen is not a bone, as might be thought, but is a series of horny plates ranged along the two sides of the upper jaw. A full-sized Greenland whale may possess as many as 400 of these plates on each side of and at right angles to the jaw. The mouth is egg-shaped, and the plates vary in length, the longest being near the middle and 10 ft. to 12 ft. in length, while the shortest are at the front and back of the jaw. They are triangular in shape, the base being attached to the palate; and the inner edge is frayed with stiff hairs. Normally the plates lie flat along the jaw with the frayed edge toward the throat, but when the whale opens his mouth they automatically hang down.

It seems almost incredible that these great animals, which grow to a length of from 50 ft. to 75 ft., feed only on shrimps or other small marine life, which are consumed in enormous quantities. With his 20-ft. jaw wide open, the Greenland whale will swim into a shoal of shrimps and receive several thousands of them, together with a considerable quantity of water that he discharges by partly closing his jaws and raising his huge tongue to the roof of his mouth. The water quickly drains out at the sides of his mouth, but the shrimps and other tiny creatures are held back by the fringe of the baleen and are passed down the throat. A full-sized Greenland whale may possess a ton of whalebone, and at one time these creatures were hunted ruthlessly for this commodity, a ton then being valued as high as £3,000. Nowadays the price obtained for whalebone is considerably less.

The Greenland whale looks like a series of humps, the most conspicuous of which contains a blow-hole through which he discharges water that he has accidently taken in during breathing or eating. This habit of the whale is an unfortunate one for him, as it betrays his presence to the lookout man on the whaling ship and is the occasion for the familiar cry: "There she blows!" Another and more formidable feature of the Greenland whale is the huge tail that he always flourishes when he dives, or uses as a flail when he is attacked and wounded. With one blow of his tail he can smash any boat that is unfortunate enough to be in the way. He is found in all the oceans, but favours particularly the icy waters of the Arctic region.

The Nordcaper Whale is similar to but smaller than the Greenland whale, and is distinguished by a series of horny, honeycombed prominences on its head, which are known as the "bonnet," and are believed to have been created by the creature scraping its nose against rocks to get rid of barnacles. When attacked he makes a fierce fight for life.

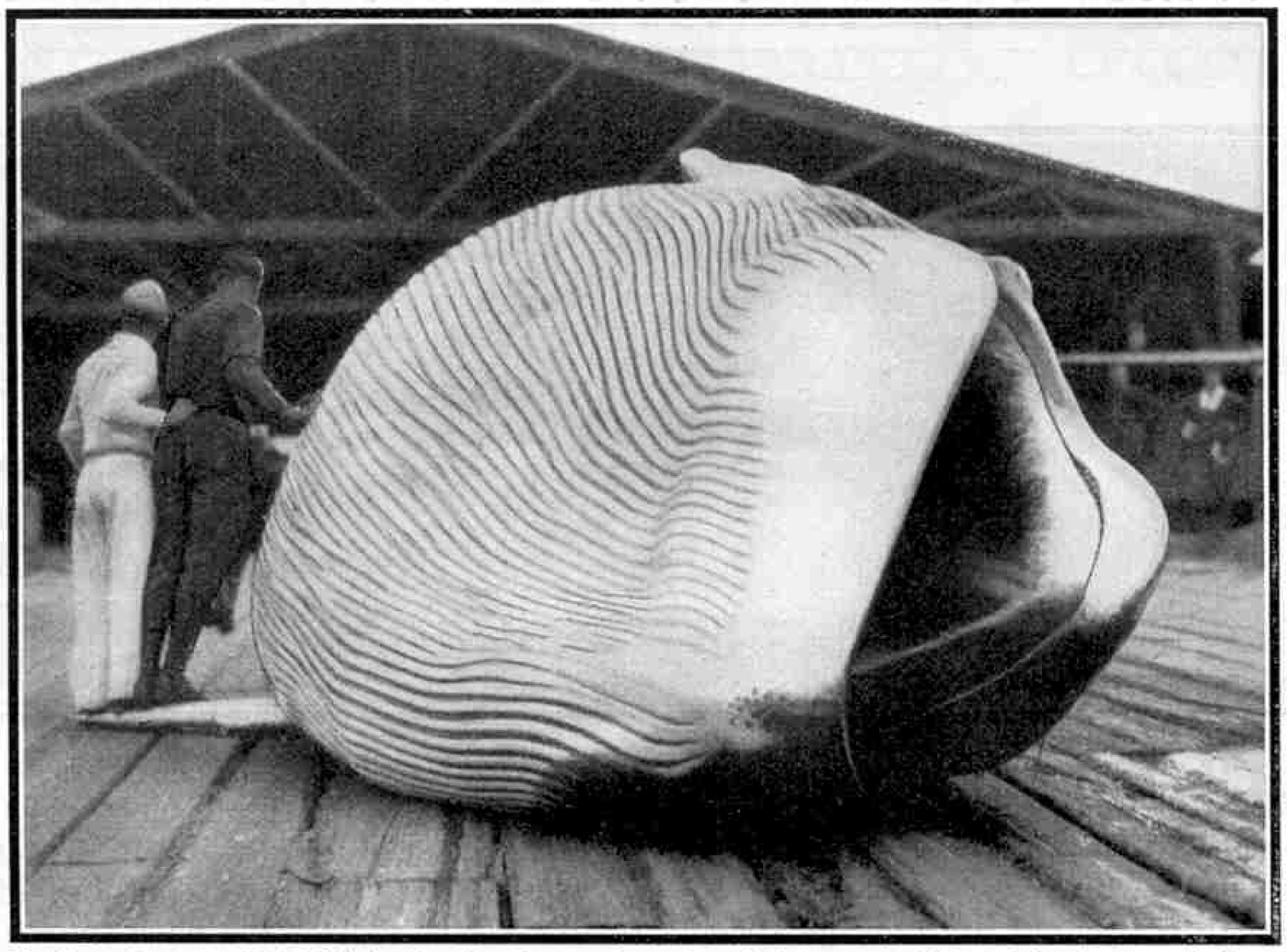
Another type of whalebone whale distinguished by a physical peculiarity is the Humpback Whale, which has a prominence on its back by which the fin is supported. It is an ungainly but sportive creature, about 45 ft. long, and with flippers almost as long as itself. The Humpback Whale is found wherever whales exist, and is sometimes seen off the coast of Britain.

The commonest whales are the whalebone species known as Rorquals. Of these the Blue Rorqual or Sibbald's Finwhale has the distinction of being the largest of all types of whale. In fact it is the largest living animal, and in the northern seas grows to a length of 80 ft. to 100 ft.; in the south it rarely exceeds 80 ft. The common Rorqual is slightly less and attains a length of 60 ft. to 70 ft., while the lesser Rorqual is still smaller. Rorquals feed on fish such as herrings and pilchard, which they catch singly or a few at a time and retain in a large collapsible pouch in the lower jaw. When this pouch becomes conveniently full the whale empties it at one swallow! The Rorqual has no claim to beauty. Its head accounts for nearly one-quarter of its length; its eyes are where one would expect its ears to be, and its ears are represented only by a small hole close to each eye. The creature breathes through nostrils sunk in the top of its bald head, and the finishing touches to its grotesque appearance are supplied by its lack of forehead and its huge mouth. A sharply curved fin rises from the middle of its back.

The Rorquals are very strong, and their ability to travel through

the water at a speed of 10 to 16 knots kept them immune from capture until the advent of steamships and modern whaling methods. The old-time whalers left them severely alone, for their yield of whalebone was poor as compared with that of the smaller Greenland whale, and was not considered to be worth the great risk involved in capturing and killing them. If a young harpooner were rash enough to plunge his iron into a large Rorqual, the whale, harpoon and entire length of whale-line disappeared with lightning rapidity. If the line caught for an instant on the side of the boat, the craft and its occupants were instantly dragged under water, or were towed along so fast and violently that very soon the boat capsized.

The giant among toothed whales is the Sperm Whale, or Cachalot, which grows as big as the Greenland whale and is distinguished from other species by its huge, flat-topped and almost square-nosed head. This head extends for about one-third of the length of the whale, and consists almost entirely of a spongy mass in the interior of which is a cavity that contains a large quantity of very valuable oil called Spermaceti. Ages ago the Sperm whale possessed a formidable array of teeth in both its upper and its lower jaws, but now only the lower jaw is so equipped, and a few slight dentations in the upper jaw are all that remain to suggest the powerful teeth that once existed there. The teeth in the lower jaw are from 8 in. to 10 in. long and are sharply pointed.



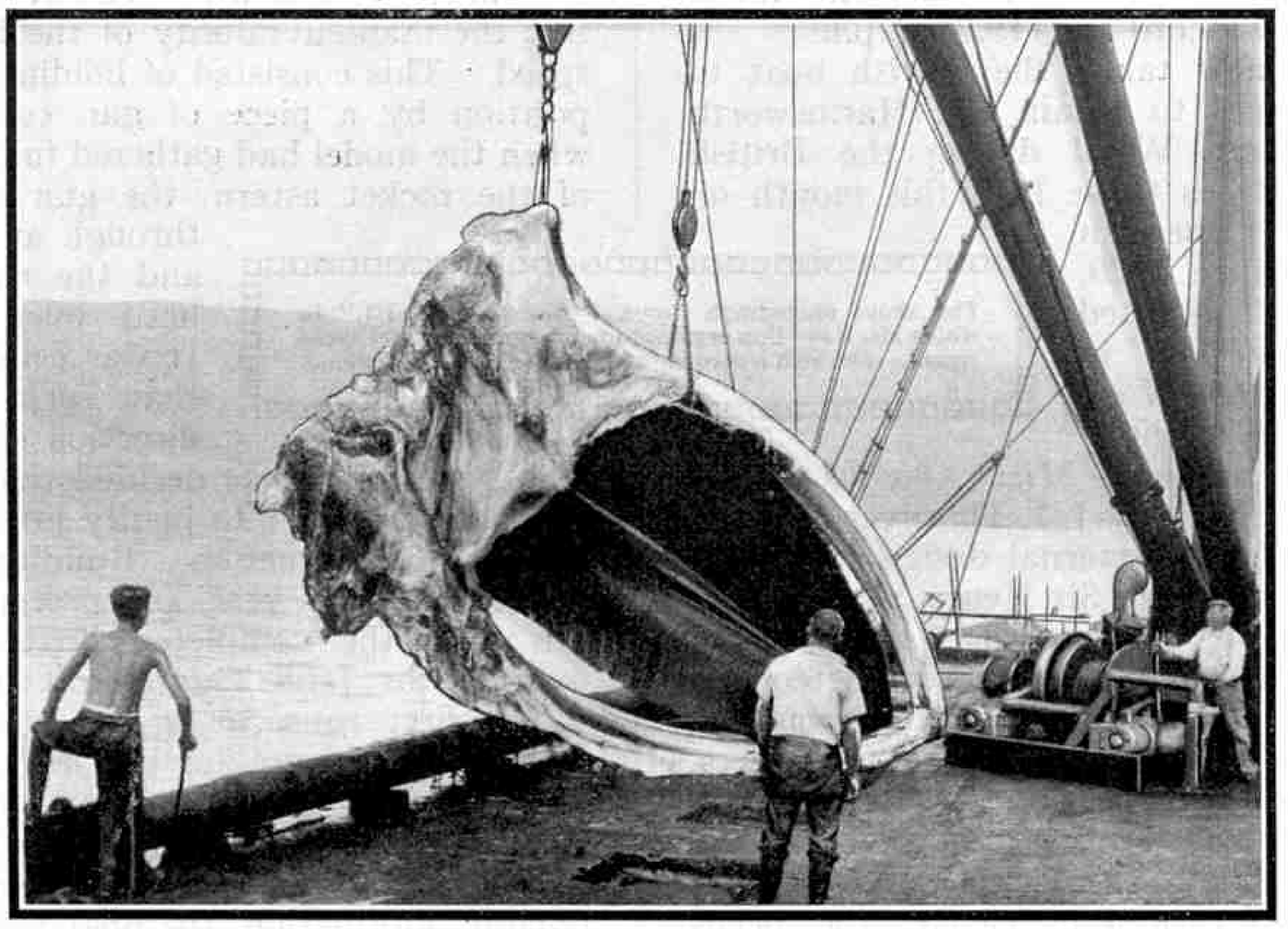
Head-on view of a Right Whale, showing the great mouth and giving a good idea of the immense bulk of these animals. The illustrations on this page are reproduced by courtesy of "Compressed Air Magazine."

Unlike its Greenland relative, the Sperm whale feeds chiefly on the huge squids and cuttle-fish of mid-ocean, and of fish such as rock cod when these are not available. Sailors who have witnessed a fight between a Sperm whale and a cuttle-fish have spoken of the encounter as a never-to-be-forgotten sight. With its huge tentacles the cuttle-fish strives to crush the whale, but appears to have little effect upon it. In the meantime the whale proceeds to bite off and swallow the tentacles of the cuttle-fish in pieces 6 ft. or 7 ft. in length, for subsequent digestion. When we remember that the tentacles are nearly 3 ft. thick, we get some idea of the size and formidable character of these deep-sea creatures. Examination of a captured Sperm whale has sometimes revealed great wealds across its body that have been caused by the powerful "suckers" of cuttle-fish during their fight for life.

The Sperm whale is much more aggressive than the Greenland whale, and when attacked and wounded will make furious rushes at the boats of the whaling ship, and even attack the vessel itself. Charging a boat with tremendous force, the infuriated whale can destroy it at a single blow and crush the timbers to matchwood with its powerful jaws. The Sperm whale is hunted chiefly for the spermaceti already mentioned, and for the sperm oil obtained from the blubber round the body; these are used as ingredients of ointments and in the manufacture of candles and soap. Occasionally a whale is caught that yields a supply of anbergris, which is used as the basis of some of the most costly perfumes and fetches a high price. Ambergris is an unpleasant-smelling fatty secretion formed in lumps in the intestines of the whale and is the result of disease. More frequently the stuff is found floating in the water or washed up on shore. The teeth of the Sperm whale make valuable ivory.

Whales are great divers, and after coming to the surface to breathe they will descend perpendicularly to a depth of from 4,000 ft. to 5,000 ft. A whale descending to 5,000 ft. is subjected to a pressure of almost 140 tons per sq. ft. of its body, and its ability to withstand this enormous water pressure is believed to be due partly to the thick coating of blubber immediately beneath its skin. This blubber also conserves the heat of its body and enables it to travel from tropical seas to Polar regions without discomfort. Whales are great travellers, and Sperm whales captured in the Atlantic have been found to be carrying harpoons thrust into them when they were in the Pacific. A whale can remain under water for as long as 50 minutes at a time.

The story of whaling is almost that of exploration, for in many instances the opening up of new whaling grounds has followed upon the reports of merchant adventurers and explorers, especially in the Arctic and Antarctic regions. The Norwegians were hunting whales in the North Sea as long ago as the ninth century, and in the 12th century the Basques on the North coast of Spain carried on whaling in the Bay of Biscay. They erected lookout towers on the high points and islands, and watchers warned the villagers when a whale was observed. The Basques obtained a good price for the blubber oil. The lungs of the whales were reserved for the priests, and the meat was greatly valued by the villagers.



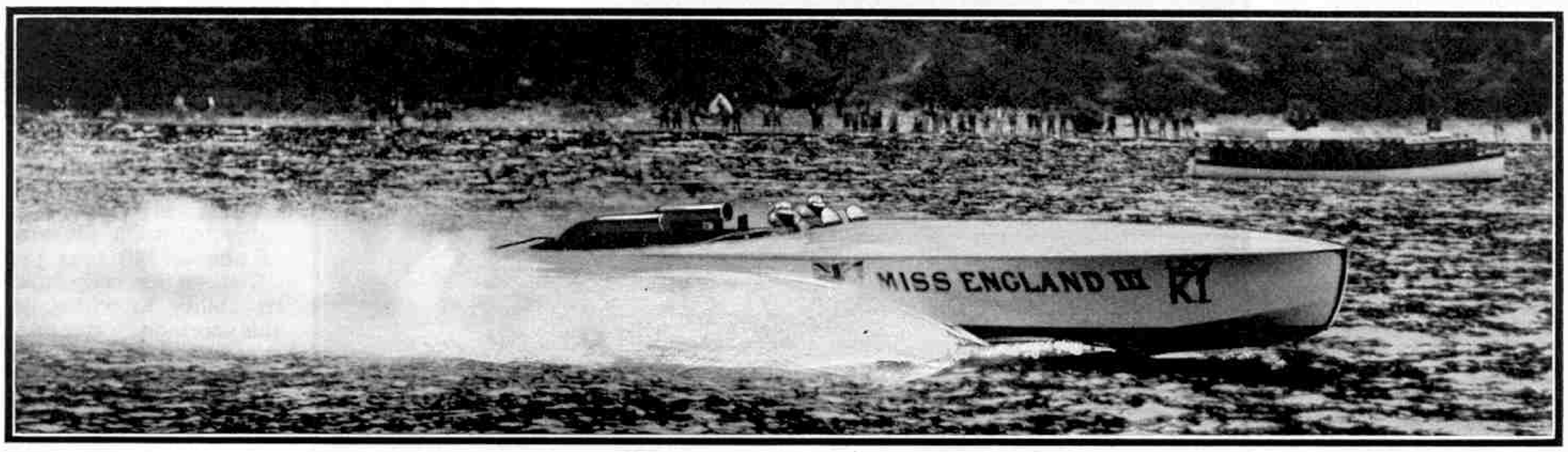
Hoisting the head of a Whalebone Whale aboard the ship. Beyond the huge lower jaw can be seen the baleen of the upper jaw.

Whaling was in progress off the East coast of Scotland in the 13th and 14th centuries. It is on record that Alexander II granted half of the blubber of whales captured in the Firths of Forth and Tay to provide altar candles in Dunfermline Abbey. In 1600 whaling ships from the Bay of Biscay were operating as far north as Iceland and even off the coast of Newfoundland. By that time British whaling ships had begun to seek a share of this profitable trade. In 1594 a British whaling expedition had been sent to Cape Breton, Nova Scotia, and for several years from 1598 whaling ships sailed from Hull to Iceland and the North Cape.

In April 1607, Henry Hudson, the great explorer, sailed from London to seek the North-West passage (*Continued on page 729*)

The Triumph of '*Miss England III*'

Water Speed Record of 119.75 m.p.h.



The above photograph shows "Miss England III," in which Mr. Kaye Don regained for England the water speed record. The boat is seen gathering speed on Loch Lomond.

ON 18th July last, Mr. Kaye Don, piloting Lord Wakefield's "*Miss England III*" on Loch Lomond, succeeded in regaining for England the world's water speed record by covering a measured nautical mile in opposite directions at an average speed of 119.81 m.p.h. He thus also regained for Great Britain the "triple crown" of world's speed records in the air, on land and on the water. Mr. Don made his first run at the amazing speed of 120.5 m.p.h., and the time for the return journey was 34.8 sec. giving a speed of 119.12 m.p.h. The previous record was held by Commodore Gar Wood, who early this year attained 111.71 m.p.h. in "*Miss America IX*," and the official figures of Mr. Don's new record are 119.75 m.p.h.

Mr. Kaye Don has now taken the British boat to America, where he hopes to regain the Harmsworth Trophy from Commodore Wood during the British International Trophy Races to be held this month on Lake St. Clair. The American has held this trophy since 1920, when "*Miss America*" defeated the British "*Maple Leaf IV*" in Osborne Bay. Commodore Wood will use in the race a specially constructed new boat named "*Miss America X*."

"*Miss England III*," built by J. I. Thornycroft & Co. Ltd., is somewhat similar in external design to "*Miss England II*," the boat in which Sir Henry Segrave and Mr. Kaye Don set up previous records. In the older boat some difficulty was experienced in keeping control when cornering. This trouble has been overcome in "*Miss England III*" by the provision of three rudders, two at the rear and the third forward of the step in the hull. They are all controlled from a normal steering wheel on the starboard side of the cockpit, and the boat can be further assisted in turning by varying the speeds of the two propellers.

In the design of "*Miss England III*" it was essential to produce a boat with the highest possible speed, but it was even more essential that the boat should be quite seaworthy and safe to manœuvre at high speed. It is therefore not surprising to find that, although only a comparatively short time was available for the construction of the vessel, many weeks were spent in making involved calculations in respect to every little detail.

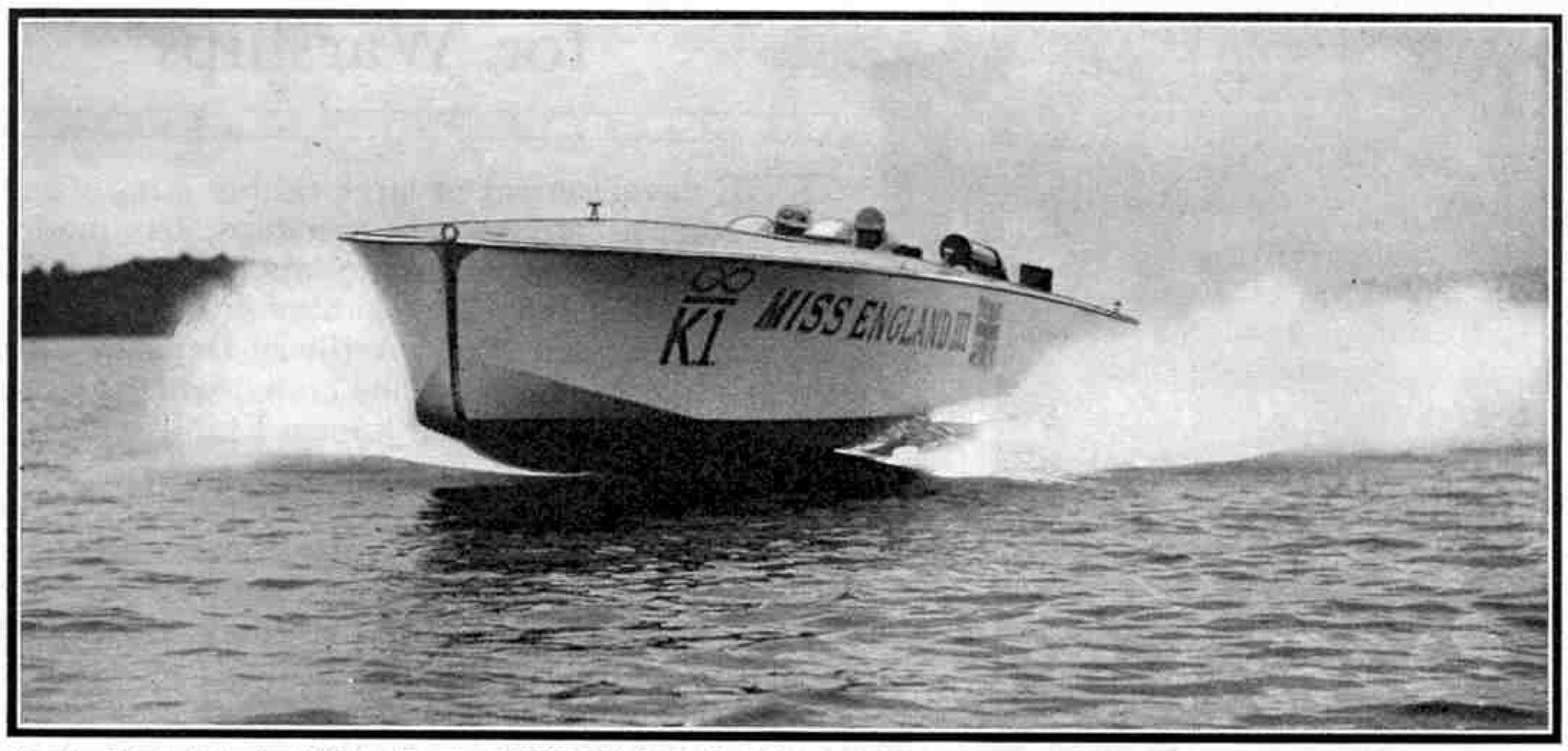
The initial calculations were succeeded by a series of tests in the Thornycroft experimental tank. These were carried out on a number of wooden models made exactly to scale, each with some particular characteristic that, in conjunction with extremely sensitive instruments, would show by practical tests, as distinct from theoretical calculations, the most suitable form of hull.

The next phase of the experiments was the building of a model hull to one-tenth of the scale of the proposed boat. This was subjected to a further series of tests during which rockets were used to propel the model, and an interesting arrangement was devised in order to test the manœuvrability of the hull when travelling at speed. This consisted of holding the forward rudder in position by a piece of gun cotton so arranged that, when the model had gathered full speed under the power of the rocket astern, the gun cotton fuse was burnt through at a pre-determined time and the rudder was then pulled hard over by a rubber band. It was established in this manner that such a sudden change in direction did not affect the boat's stability, and it was decided that the form of hull was sufficiently correct to justify proceeding with the actual work of construction. Building was commenced in February of this year, and proceeded so rapidly that on 9th May the completed boat was formally handed over by Sir John Thornycroft to Lord Wakefield.

The first runs, made on Lake Garda in Northern Italy, were encouraging but not completely satisfactory, and after Mr. Don had spent much time at the wheel in order to familiarise himself with the craft, and also to enable the Thornycroft experts present to acquire reliable information, the boat was returned to England. Several slight but important modifications were then made, one being the substitution of the Rolls-Royce engines that had been transferred from "*Miss England II*" for the preliminary runs by a pair of new Schneider-Trophy-type 12-cylinder Rolls-Royce engines.

It was decided that the attempts on the world's speed record should be made on Loch Lomond, but when high-speed runs were resumed it was evident that "*Miss*

England III" was still not functioning satisfactorily. Bad luck seemed to dog the attempt, for first the boat, and then the slipway or the weather, caused aggravating delays. Eventually, however, after various minor adjustments had been made, the boat was deemed satisfactory. At dawn on 18th July, conditions of both the boat and the weather being satisfactory, Mr. Kaye Don and his engineer, R. Garner, became the first to travel on water at a speed of over two miles a minute.



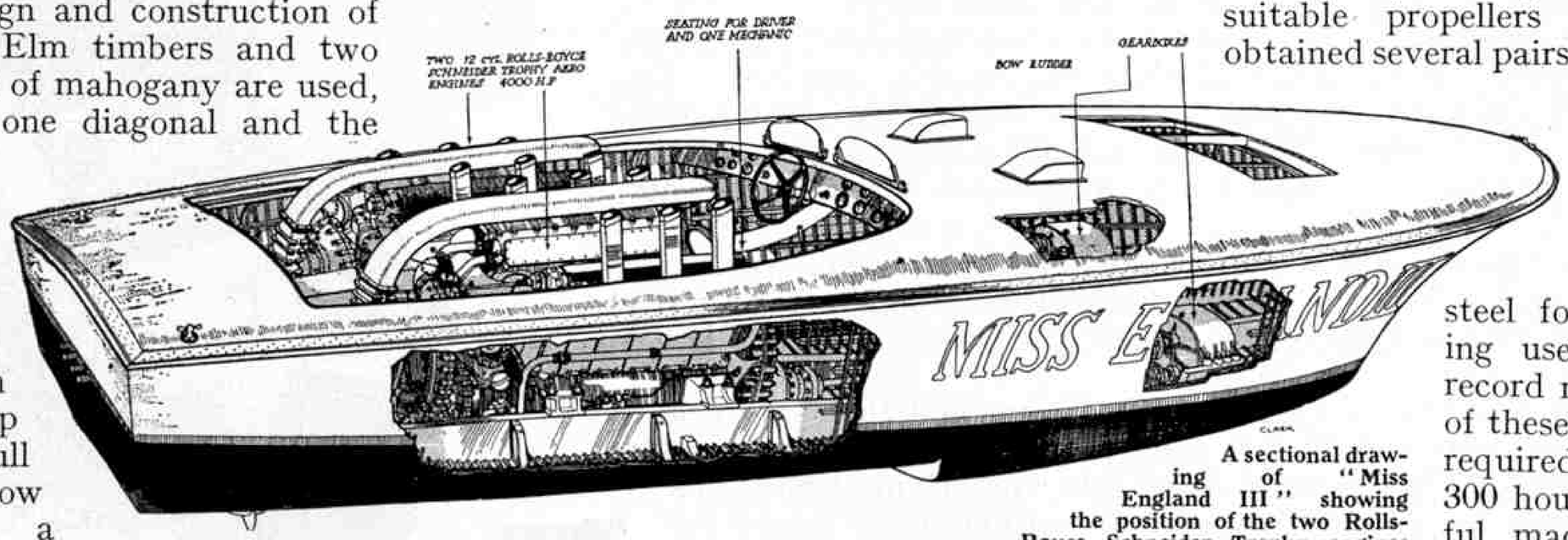
A splendid photograph of "Miss England III" at high speed. The stepped arrangement of the hull is well shown. For this and the photograph on the previous page we are indebted to J. I. Thornycroft Ltd.

"*Miss England III*" is of the hydroplane type of "skimming" boat, a type that was first evolved by Sir John I. Thornycroft in 1877, when he took out patents for boats having hulls with a transverse step designed to skim along the surface of the water. In those early days development was impeded by lack of sufficient propelling power, and it was not until the arrival of the internal combustion engine that any real progress was possible with this type.

The "*Miranda IV*," built in 1910, was the most successful of the early skimming boats, and it was on this vessel that the famous Thornycroft Coastal Motor Boats, familiarly known as C.M.B.'s, were based. These were built during the War for submarine chasing and other coastal work, and "*Miss England III*" resembles them in the design and construction of her hull. Elm timbers and two outer skins of mahogany are used, the inner one diagonal and the outer laid fore-and-aft with oiled fabric between. A third skin is built up on to the hull from the bow to form a straight transverse step more or less amidships, on which the boat skims when her bow rises and clears the water as her speed increases. Abaft this the hull is rounded, gradually merging into a sharp chine edge to the square transom. Four deep built-up engine bearers running from bow to stern form a backbone of immense strength, properly bracing the whole of the hull and engine installation into one unit. The hull is 35 ft. in overall length, and has an outside beam of 9 ft. 6 in.

As already mentioned, the engines employed are two Rolls-Royce Schneider Trophy engines. They are each of 12 cylinders with a bore and stroke of 6 in. by 6.6 in., and develop a total of 4,400 b.h.p. at 3,200 r.p.m. The weight of each engine is 1,630 lb., giving a power weight ratio of only 12 oz. per b.h.p., compared with the average 10 lb. of motor car engines. Superchargers are fitted to each engine, and these rotate at the almost incredible rate of 25,600 r.p.m. when the engine is running at full power. The fuel consumption at full throttle is approximately five gallons a minute, and the petrol tanks hold 160 gallons, or sufficient for about 30 minutes' running. The twin engines drive through forward shafts to separate gear-boxes of what are known as the "elephant" type. Each of these consists essentially of a large gear wheel driven by the shaft from the engine, which meshes with a smaller gear that returns the drive aft, being connected to the propeller shaft. The engines, gear-boxes and transmission are all water-cooled through scoops that pick up water as the boat travels and discharge it aft, thus providing a constant circulation of fresh water.

The twin propellers rotate at 7,000 r.p.m. at full engine power, and are carried on steel shafts running in special rubber bearings. They are arranged to rotate in opposite directions, and in order to allow of this it was necessary to reverse the rotation of the port engine. Before suitable propellers could be obtained several pairs were made in bronze and in steel, a pair cut from high tensile steel forgings being used on the record run. Each of these propellers required more than 300 hours of careful machining!



A sectional drawing of "Miss England III" showing the position of the two Rolls-Royce Schneider Trophy engines with which the vessel is equipped, and the accommodation provided for the pilot and his engineer. By courtesy of "The Yachting Monthly and Motor Boating Magazine."

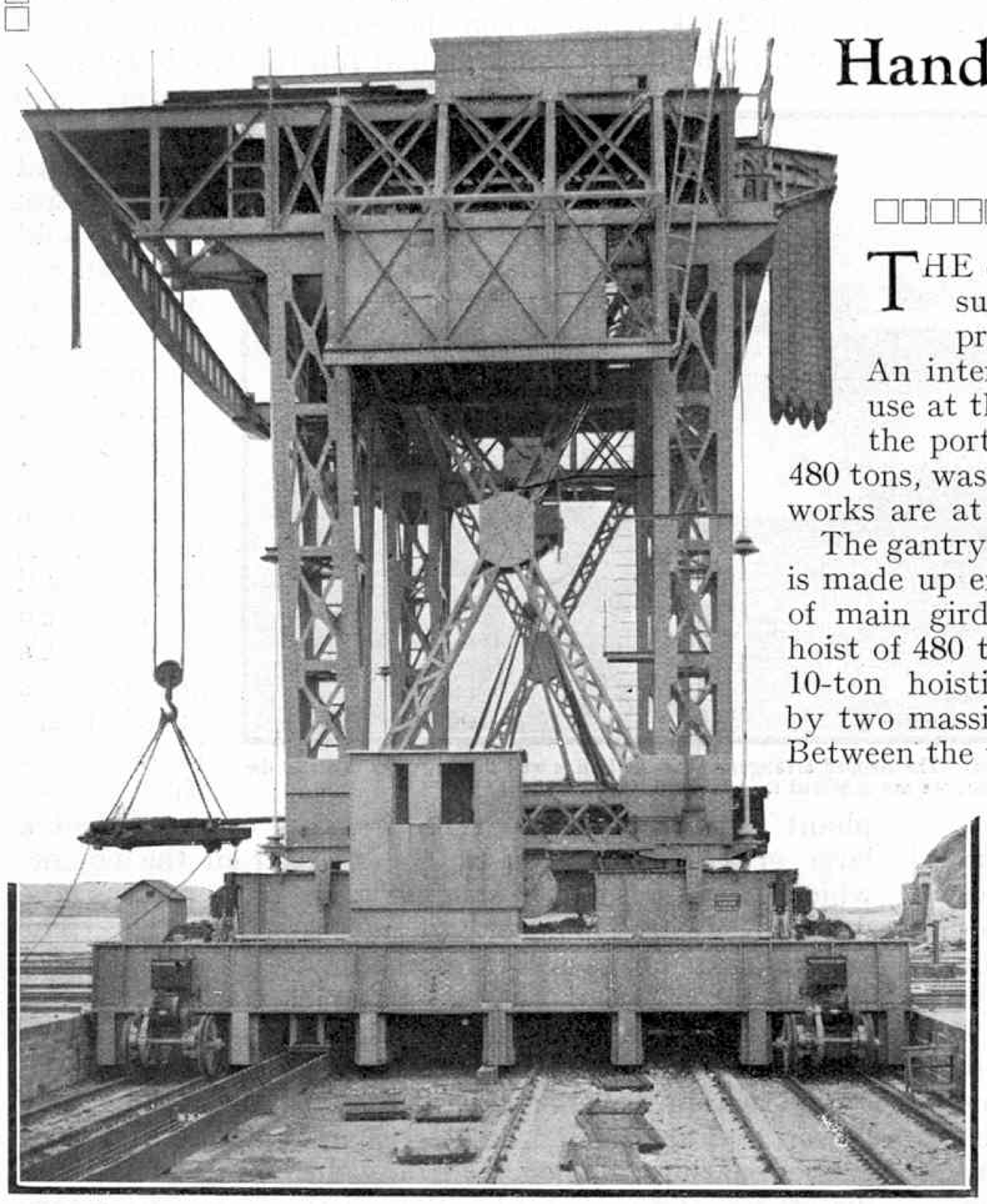
The pilot and the engineer sit forward of the engines, and the control wheel, which is on the starboard side of the cockpit, is connected to a steering box. The drop arm of this is coupled to the forward rudder, which in turn is linked by a steel cable running through roller guides to the twin rudders aft.

The throttle controls of the engines are arranged in a particularly interesting manner. Control rods lead from each separate engine to an accelerator pedal having a differential balancing action. When the pedal is fully depressed both throttles are

(*Continued on page 720*)

A 480-Ton Gantry Crane

Handling Large Calibre Guns for Warships



THE development of large calibre guns of enormous weight, such as are used in warships, has made necessary the provision of adequate appliances for handling them. An interesting travelling gantry crane for this purpose is in use at the French Naval Artillery Department at Gâvre, near the port of Lorient. This crane, which is capable of lifting 480 tons, was built by the well-known Etablissements Daydé, whose works are at Creil in the Oise Department.

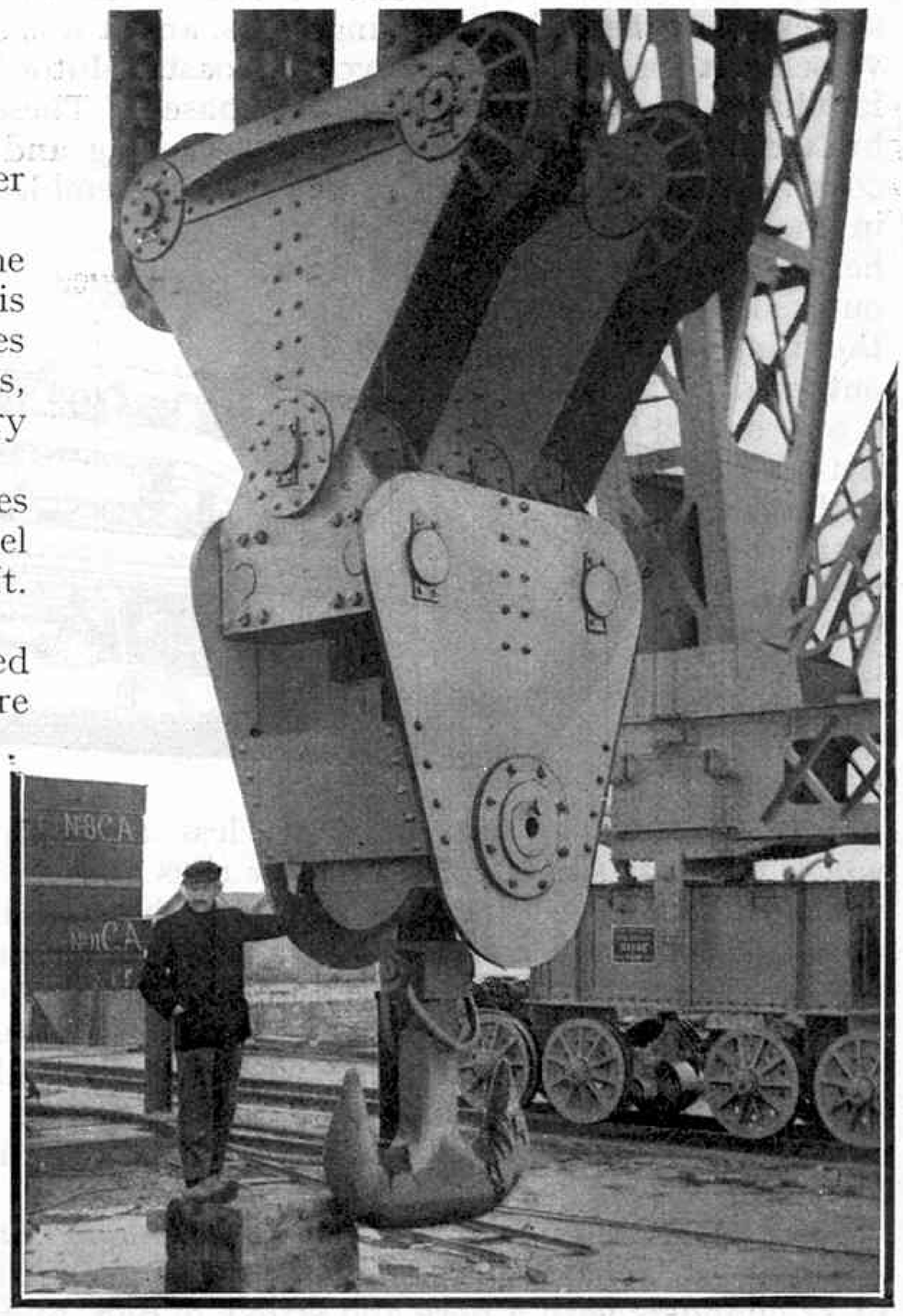
The gantry of the crane, on which the trolley hoists are supported, is made up entirely of immense steel beams arranged in two pairs of main girders forming the cross runway for the main trolley hoist of 480 tons' capacity, and two single girders, which carry the 10-ton hoisting trolley. These girders are connected together by two massive longitudinal cross girders and two outside beams. Between the twin girders supporting the main hoist trolley and the single girders is a passageway, and a similar passage runs between the inner double crossbeams and the outer ones. A network of ties and struts arranged in trellis formation are placed below the passageways to ensure perfect rigidity. The gantry is supported by four pillars or legs, each of which is cross-stayed. The lower ends of the pillars are cross-tied by horizontal built-up girders, and also by a vertical lattice girder arranged in the form of a St. Andrew's Cross, the lower arms of which are supported by the horizontal girder.

Below the gantry is a roomy cabin in which is housed part of the electrical equipment by means of which the crane is operated. This cabin serves also as the control post for the crane driver, who reaches it by means of a ladder. The crane travels on rails of 49 ft. centres, and the height from the rails to the underneath side of the gantry is $50\frac{3}{4}$ ft.

The crane travels on four massive eight-wheeled bogies, two bogies supporting each side of the crane. Each of the pillars rests on a steel bolster supported in turn on the bogies, each wheel of which is 3 ft. in diameter.

Only four wheels of each bogie are driven, and these are worked through gearing by two 11 h.p. electric motors. In order to ensure that each bogie is driven at an equal rate, the driving wheels are interconnected by cross shafting, the shafting being joined by teliscopic joints to allow for any slight mis-alignment that might occur when the crane is carrying a heavy load. If one of the driving motors should fail, an automatic brake comes into operation and locks the transmission gearing, thus bringing the bogies to rest.

The main winch house is built from steel plates bolted to a framework of girders, and houses the main hoisting winch, which is capable of handling a load of 480 tons. The winch house is mounted on four sets of four-wheeled bogies, the axles of which are articulated. The bogie wheels are each 3 ft. in diameter



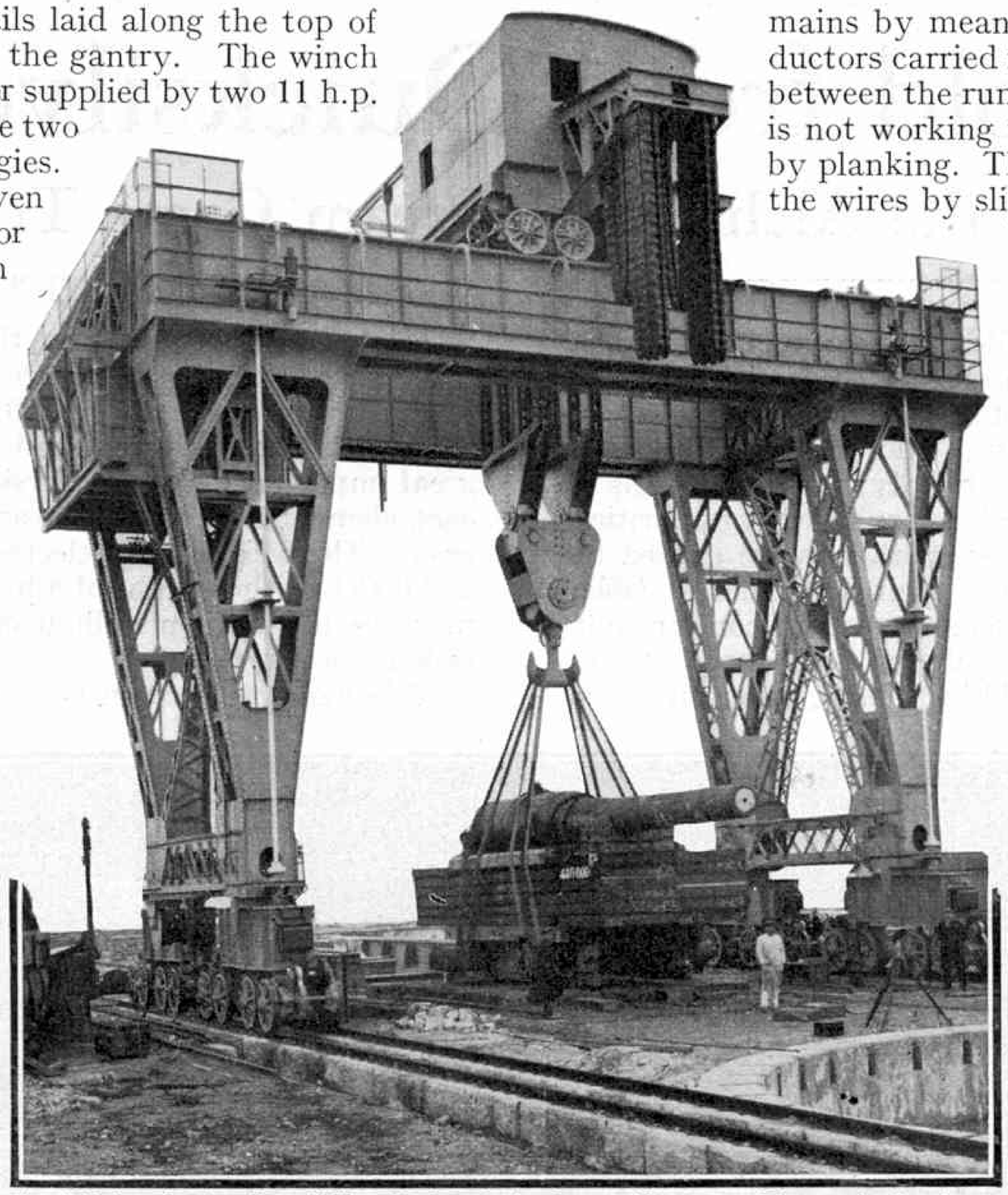
(Above) An end view of the 480-ton Gantry Crane described in this article, showing the 10-ton auxiliary hoist and the main hoist chain racks. (Right) The main hoisting block and load hook. The hook swivels on a large diameter ball race hidden behind the triangular steel plates. This arrangement allows easy manipulation of the load, and reduces the side strain on the lifting chains.

and run on two sets of rails laid along the top of one of the main girders of the gantry. The winch house is traversed by power supplied by two 11 h.p. electric motors, which drive two of the eight axles of the bogies.

The winch drum is driven by a 90-h.p. electric motor through irreversible worm gearing, and is fitted with a solenoid - operated band brake.

The load is lifted by immensely strong roller chains, composed of massive steel links, which pass over two parallel sprockets in the hoisting winch. After leaving the sprockets the links pile up automatically on chain racks outside the winch housing, so that they cannot interfere with the handling of the load. The chain racks are shown plainly in the illustrations.

The chain is suspended from four pulleys, which divide the strain equally over the eight falls of chain that support the pulley block and load hook.



The 480-ton Gantry Crane lifting the barrel of a large calibre gun. The gun is placed on a wood plank platform in order to prevent any possibility of strain on the barrel.

The illustration of the main hoist hook clearly indicates its enormous size. It is a double hook of cast steel, and swivels on a 24-in. diameter ball race that in turn is suspended from the pulley block by a universal joint, so that it is free to swing in any direction.

The auxiliary hoisting winch, which has a lifting capacity of 10 tons, is mounted on cast steel wheels and travels on rails laid on the single girders of the gantry. The traversing machinery and the 10-ton hoist winch are driven separately by two motors of 4 h.p. and 36 h.p. respectively.

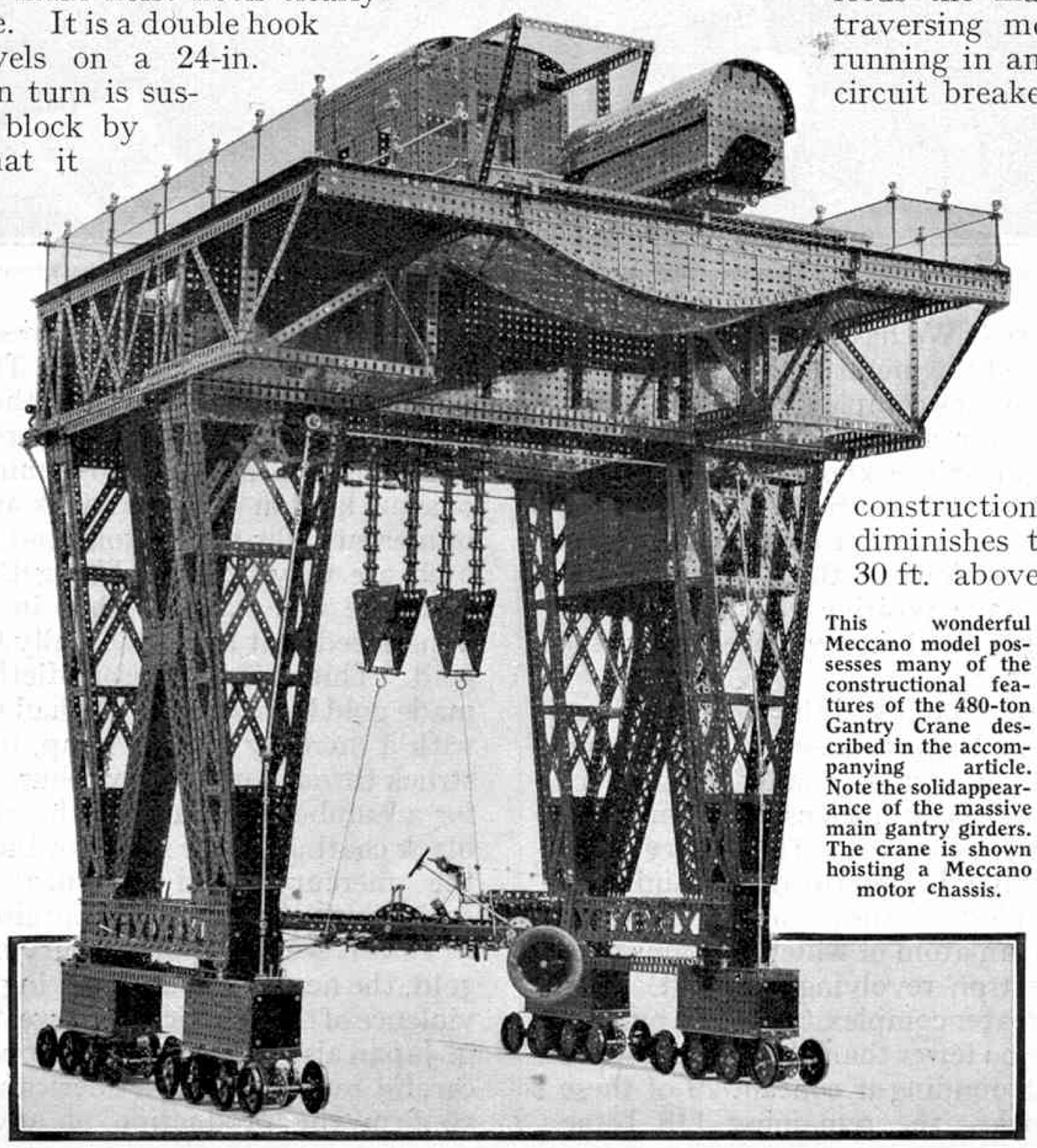
As in the case of the main hoist, the load is lifted by a link roller chain, arranged in two falls by passing it round the pulley from which the load hook is suspended.

The electric current supply for driving the many motors incorporated in the crane is taken from 240-volt mains by means of four bare copper conductors carried in open ducts in the ground between the running rails. When the crane is not working the ducts are covered over by planking. The current is collected from the wires by slippers, and is then led to a junction box and thence to the control cabin. The current is automatically cut off when the crane reaches either end of the conductors in the duct.

The control cabin contains the distribution board, voltmeter and ammeters. fuses and a converter plant. The converter consists of a 120 h.p. shunt-wound motor fed direct from the 240-volt mains. This drives two dynamos, one of 60 k.w. and the other of 16 k.w., which supply direct current at a voltage variable from 0 to 230 volts.

The 60 k.w. dynamo feeds through suitable switchgear the main travelling motors and the main and auxiliary hoisting winches, while the 16 k.w. dynamo feeds the main and auxiliary hoist traversing motors. To avoid overrunning in any operation, automatic circuit breakers are provided, which cut off the power when the range of any operation is exceeded.

The principal dimensions of this remarkable crane are as follows. At a height of 4 ft. above the running rails the width between the pillars is 41 ft., but owing to the tapered construction of the pillars the width diminishes to 36 ft. at a height of 30 ft. above the rails. The main hoist trolley has a transverse travel of $32\frac{3}{4}$ ft. The width from centre to centre of the running rails is 49 ft.



This wonderful Meccano model possesses many of the constructional features of the 480-ton Gantry Crane described in the accompanying article. Note the solidappearance of the massive main gantry girders. The crane is shown hoisting a Meccano motor chassis.

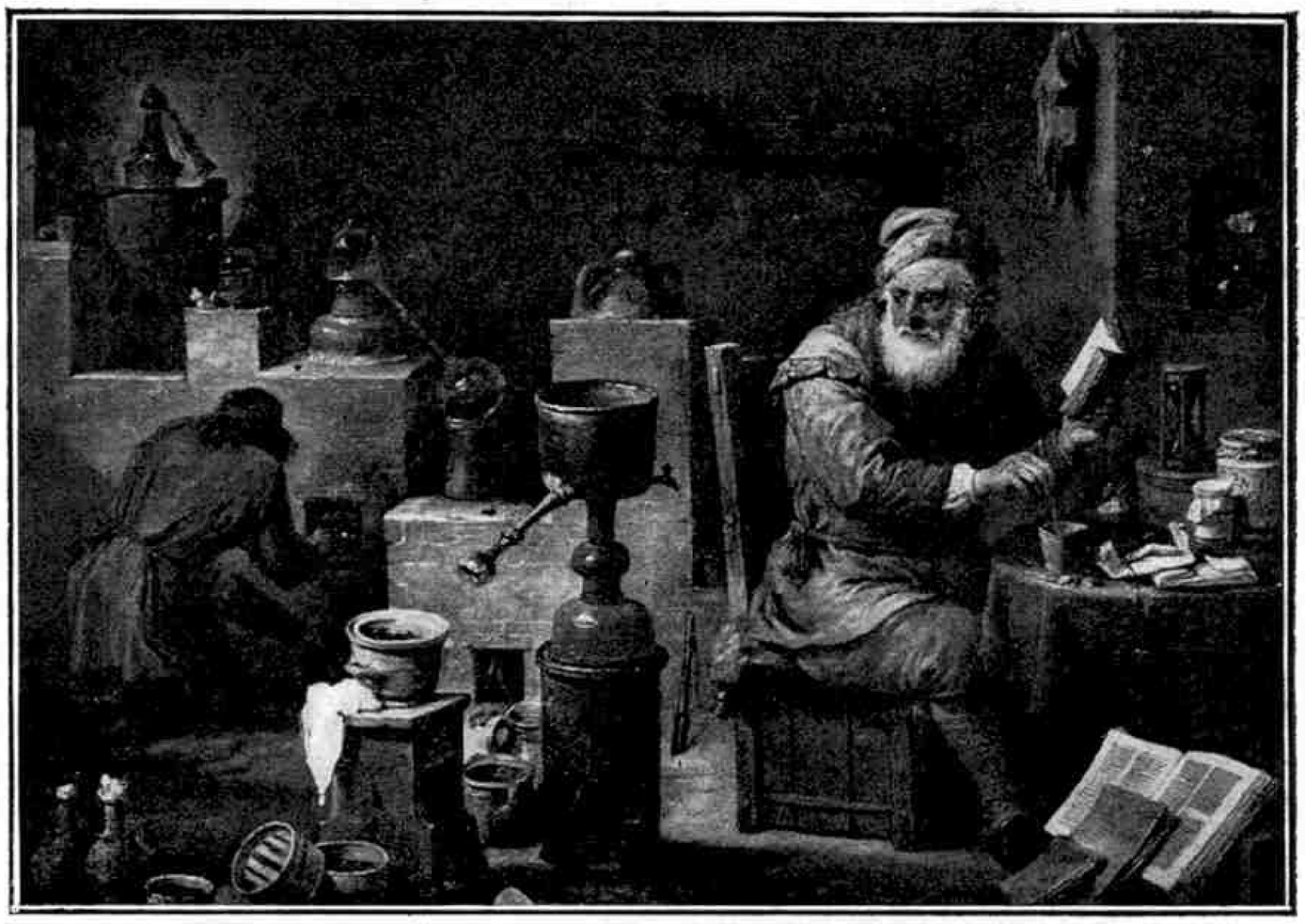
Cranes of this type are used principally for lifting and transporting heavy loads over short distances, for example, along the sides of a dock. For this kind of work gantry cranes are

(*Continued on page 729*)

Gold from Quicksilver

Will the Alchemists' Dream Come True?

THROUGHOUT the Middle Ages much time and energy was wasted in efforts to turn base metals, such as lead and tin, into gold, or at least into silver. The chemists of those days, who are usually called alchemists, believed that the metals were compounds of mercury or quicksilver with sulphur and earthy impurities, and that the differences between them were caused by variations in the proportions of their constituents. Gold, the noblest of all metals, was supposed to contain only clear quicksilver and pure sulphur, and for centuries alchemists tried to make gold by heating other metals in their furnaces, or distilling them in retorts or alembics along with various substances, in the hope of removing the impurities they contained. Many of them believed that they had succeeded in making the precious metal, but actually the utmost that had been done was to produce something that had a similar colour.



An alchemist in his laboratory searching for means of transforming base metals into gold. In the background an attendant may be seen tending a furnace on which a retort is being heated.

Alchemy, in the old sense of the word, is now in disrepute, but curiously enough thoughts of transmuting the elements have recently been revived, although in a different form. We have already explained that the alchemists believed the metals to be compounds. It is now known that they are complex bodies built up, not of quicksilver and sulphur, as the alchemists thought, but of electrically-charged particles known as protons and electrons. The non-metals also are built up from these constituents, and in fact the atoms of every element are composed of certain proportions of these two kinds of particles. The protons have positive charges and the electrons negative charges, and in every element the two neutralise each other.

The form in which these " bricks of the elements " are united is of great interest. In every case there is a heavy nucleus formed of protons and a smaller number of electrons, and round this heavy nucleus the remaining electrons revolve in a series of orbits. Thus every atom of an element forms what may be described as a miniature Solar System. The simplest of these configurations is that of the gas hydrogen, an atom of which contains only one proton, and one electron revolving round it. The heavier elements are of greater complexity. In the nucleus of the gold atom there are no fewer than 197 protons, while the rings of electrons surrounding it contain 79 of these negatively-charged particles, the remaining 118 being associated with the protons of the nucleus. Mercury differs from gold in having 80 electrons in the outer ring of its atom, its nucleus containing 200 protons and 120 electrons.

The numbers of protons and electrons in the atom are of great importance, for the physical and chemical nature of each element depends on the arrangement of its constituents. The weight of an electron is very little more than 1/2,000th of the weight of a hydrogen atom, and it takes more than a million million million hydrogen atoms to weigh one gramme!

Although the electron is so small, it is a very important part of the atom, for the number of these tiny negative electrical particles rotating in orbits round the nucleus determines how each element shall behave chemically. This number is called the atomic number of the element. The atomic number of mercury is 80, while that of gold is 79; and if by any means the extra electron could be knocked out of the atom of mercury, gold would be formed. In order to bring about this change the electron would have to be permanently eliminated in order that changes in the nucleus could restore the balance between positive and negative charges. Thus there appears to be a possibility that the dreams of the alchemists could be fulfilled, but in an entirely different manner.

It would be necessary to administer a tremendous shock of some kind in order to knock an electron out of an atom of mercury, for the protons and electrons of which this is built are very firmly held together. The scientific world therefore was startled when in 1924 a German scientist announced that he had actually transformed mercury into gold. This was Professor Miethe, who claimed to have made gold by accident. He had been making experiments with a mercury vapour lamp, in which an electric arc is struck through mercury vapour. When the arc had passed for a number of hours Miethe noticed the formation of a black coating on the inside of the quartz vessel containing the mercury, and chemical analysis revealed the astonishing fact that it contained a proportion of gold.

Thus it seemed that mercury had been transformed into gold, the necessary shock having been administered by the violence of the electric discharge. Similar experiments made in Japan also gave films that appeared to contain gold, but careful repetitions by American scientists have failed to confirm the production of any trace of this metal.

A South African Cableway

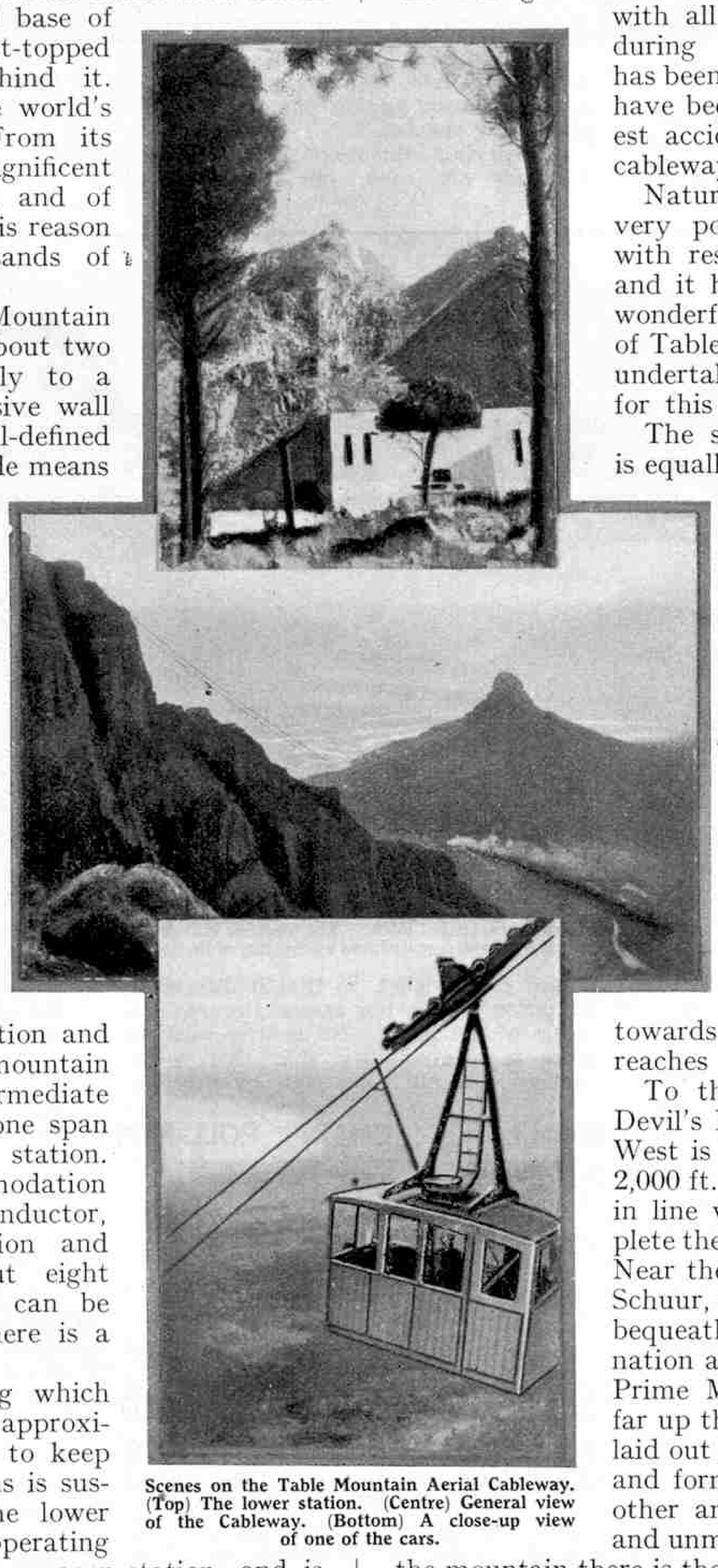
Ascending Table Mountain in Eight Minutes

FEW cities are more beautifully situated than Capetown, the capital of Cape Colony, which lies at the head of Table Bay. It owes much of its charm to its position at the seaward base of Table Mountain, the great flat-topped mass that rises steeply behind it. Table Mountain is one of the world's most famous landmarks. From its summit is obtained a magnificent panoramic view of Capetown and of the Cape Peninsula, and for this reason the mountain attracts thousands of sightseers.

The northern face of Table Mountain overlooks Table Bay, and is about two miles in length, rising steeply to a height of 3,582 ft. This massive wall is scored with ravines, and well-defined pathways up these clefts provide means of access to the summit. Until 1929 a particularly deep cleft known as "The Gorge" was the shortest way to the top of the mountain, but in that year an aerial cableway was opened for public traffic, and this enables sightseers to reach the summit from Capetown docks or harbour in half an hour.

The Table Mountain Aerial Cableway took three years to erect, and a winding motor road one mile in length had to be constructed by the company in order to reach the site of the lower station. The distance between this station and the one on the summit of the mountain is 4,000 ft. There are no intermediate stops, the cableway being in one span from the lower to the upper station. Aerial cars, each with accommodation for 19 passengers and a conductor, ascend from the lower station and arrive at the summit about eight minutes later, but this time can be substantially reduced when there is a rush of passengers.

The two main cables along which the cars are pulled each weigh approximately 12 tons, and in order to keep them taut a weight of 16½ tons is suspended on each cable, at the lower station. The machinery for operating the cableway is installed in the upper station, and is driven by 62 h.p. electric motors. Electric current is obtained from the Capetown Municipality and is conveyed by an overhead line from their Kloof Nek power station to the Cableway Company's engine house, where the 11,000 volt current is transformed to the voltage of the motors. The cableway is equipped with all the latest safety devices, and during the two-and-a-half years it has been in use about 100,000 passengers have been conveyed without the slightest accident. The construction of the cableway cost £72,000.



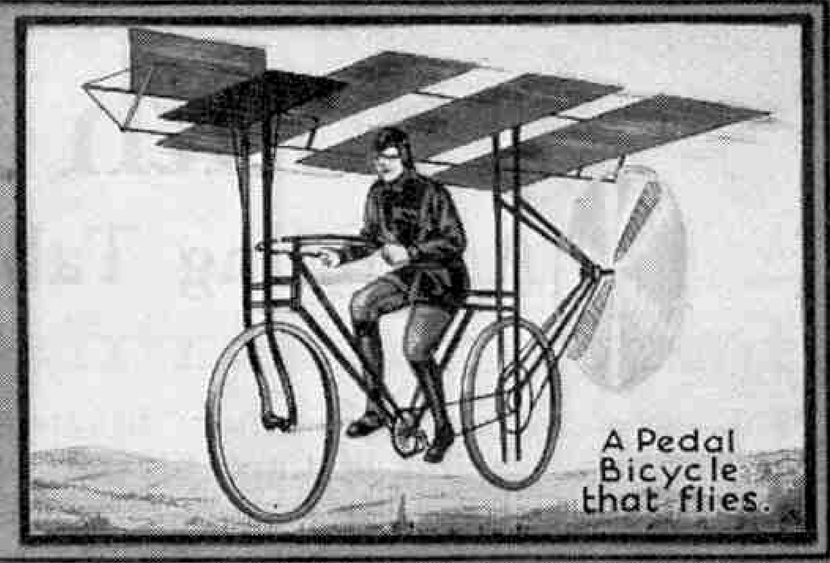
Scenes on the Table Mountain Aerial Cableway. (Top) The lower station. (Centre) General view of the Cableway. (Bottom) A close-up view of one of the cars.

Naturally the cableway has proved very popular both with visitors and with residents of the Cape Peninsula, and it has enabled many to enjoy the wonderful views obtainable from the top of Table Mountain who would not have undertaken to climb up the mountain for this purpose.

The striking view from the summit is equalled by the view of the mountain itself as seen from the city or from a greater distance. The appearance of the mountain is everchanging, and its grandeur fascinates the seasoned resident of Capetown as greatly as it does the visitor. The mountain is never more attractive than when its summit is covered with the whitish grey cloud that is popularly referred to as its "table cloth." This common phenomenon is caused by the south-east winds that sweep over the mountain and force the cloud down on its northern face towards Capetown. The cloud never reaches the lower slopes, however.

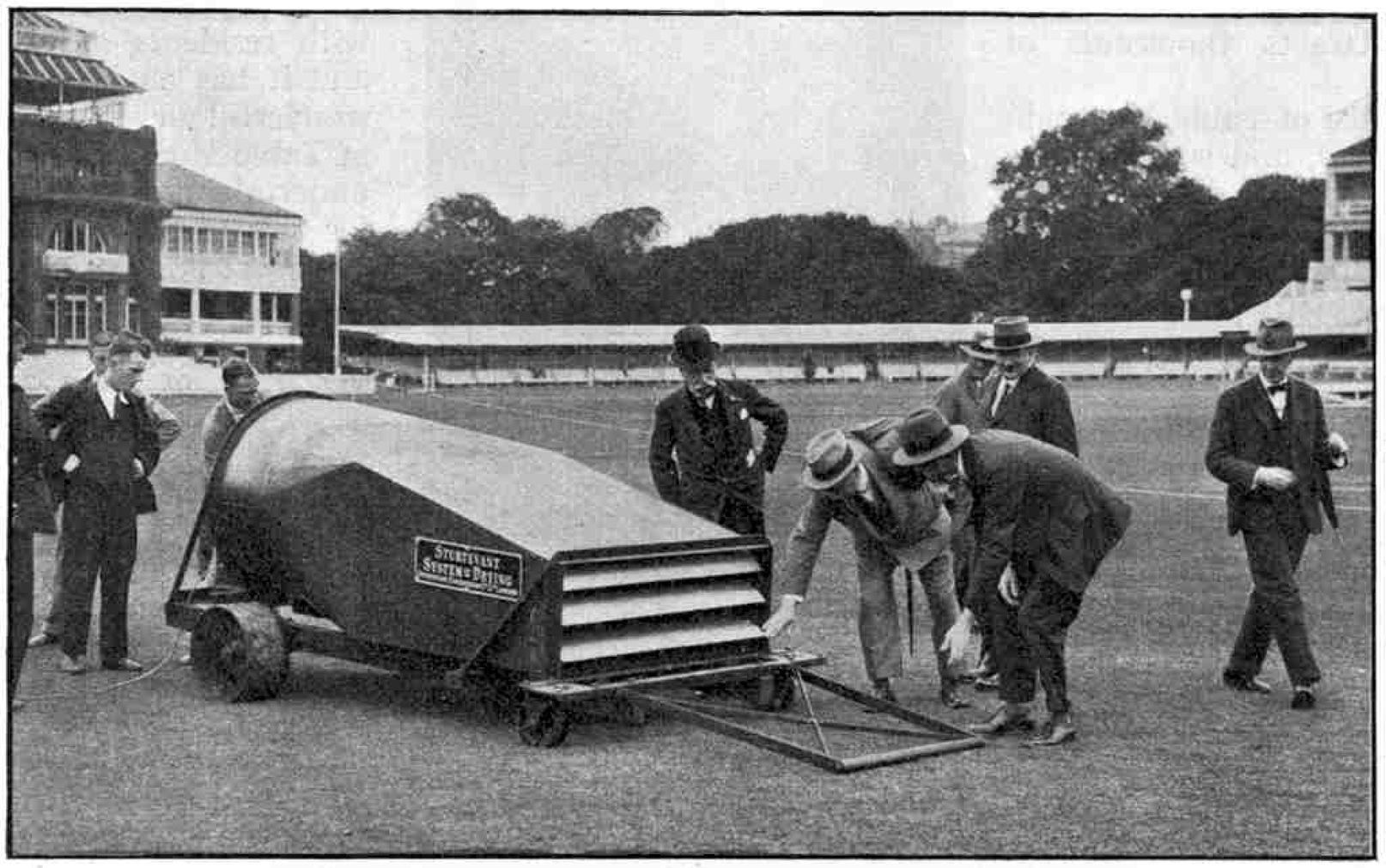
To the East of Table Mountain is Devil's Peak, 3,300 ft. high, and to the West is the Lion's Head, which is over 2,000 ft. high. These two mountains are in line with Table Mountain and complete the massive wall behind Table Bay. Near the foot of Devil's Peak is Groote Schuur, the home of Cecil Rhodes, who bequeathed it to the South African nation as the official residence of future Prime Ministers. The estate extends far up the slopes of the mountain and is laid out in gardens and woodland walks, and forms a home for buck, zebra and other animals, which live there happy and unmolested. On the higher slopes of the mountain there is the Rhodes Memorial, a fine statue by the famous sculptor Watts typifying "Physical Energy," and erected by the nation in memory of the man who literally wore himself out in the service of South Africa.

OUR BUSY INVENTORS



Artificial Gale to Dry Cricket Pitches

The amount of playing time that has been wasted in county cricket matches on account of rain makes any scheme to improve matters in this respect worthy of serious consideration. Probably nothing can be done to counteract the effects of heavy and long-continued rain, but a recently-introduced machine appears to have great possibilities for dealing with the effects of showers. It is a common experience for the commencement of play to be delayed until lunch, or even later, while the ground is drying after an early shower. On a dull and windless day this drying is very slow, but with a brisk wind and a certain amount of sun it is speeded-up very considerably. The object of the new machine, which has been constructed by the Sturtevant Engineering Co. Ltd., of London, is to provide an artificial wind, available at any time.



Producing an artificial gale in order to dry up a cricket pitch. The machine introduced for this purpose is described in the accompanying article, and our photograph is reproduced by courtesy of the Sturtevant Engineering Co. Ltd.

The machine consists of a specially-designed fan mounted upon the extended shaft of an electric motor that is capable of an output of 2½ h.p. The fan discharges air into the circular end of the sheet steel duct shown in the accompanying illustration. This air escapes at the rectangular end of the duct, which is fitted with louvres that can be adjusted in order to deflect the air current in a downward direction on to the pitch. The underside of the duct is not open, so that all the air is discharged from the louvred outlet. The motor and the fan, together with the duct, are mounted on a framework fitted with broad flanged wheels at the rear carrying the bulk of the load, while the forward wheels take the form of ball-bearing swivelling castors; so that the whole apparatus can be moved about easily on wet ground without doing any damage to the turf. Although the machine is about 10 ft. in length and 4 ft. in width, it may be handled easily by a couple of men. Where electric current is not available, an air-cooled single-cylinder petrol engine can be supplied for driving the fan.

For drying operations two of these machines are used, one being placed behind each wicket, so that it directs an air current over the crease towards the centre of the pitch. No heat is used, as there is a possibility that this would damage the pitch through over-drying,

An easily-made drying board for roll films. Its use prevents the films from curling.

and thus producing surface cracks. Tests carried out by the authorities at Lord's cricket ground indicate that the use of the machines for two hours or so will greatly reduce the time required for the pitch to come into condition suitable for play. The results of further tests will be awaited with interest by all cricket enthusiasts.

Lorry with Movable Floor

A recently invented alternative to the tipping gear employed on many motor vehicles is a movable floor, in which the deck of the lorry is converted into a conveyor belt by making it of rows of hollow steel tubes, placed parallel to the rear axle and mounted on spindles and ball races in such a manner that they form continuous belts passing round split wooden rollers at the ends of the vehicle.

Coal and similar materials may be discharged from the new lorry by simply turning a handle, when they are carried to the back and shot over the edge. Loading is equally simple, particularly in the case of bricks, tiles or goods in sacks, for these may be placed on the edge of the belt at the rear and moved forward by turning a handle at the front of the lorry. Loads of five tons may be discharged in a few seconds, and special double reduction control gear is employed to enable loads of as much as 12 tons to be easily handled, and during the process the load is never concentrated on one part of the vehicle, as usually is the case with ordinary tipping lorries.

Anti-Dazzle Headlights for Motor Cars

Many devices for preventing dazzling effects from the powerful headlights of motor cars have been suggested, but most of these depend on dimming the light or on changing the direction of the beam. The "Anti-dazzle" headlight invented by Mr. J. Bayley, Chelford, Cheshire, does not suffer from these defects, for in it a translucent screen mounted on the lamp socket may be pulled round into such a position that pedestrians and the drivers of oncoming cars are protected from the glare. The screen is moved by means of a Bowden wire or flexible cable controlled by the driver of the car to which the headlight is fitted, and a spring carries it back into its usual position when it is no longer needed.

Bridges Built on Floating Piers

A patent for a new type of bridge has been secured by a Scottish inventor. The purpose of this is to provide means of spanning rivers or firths in which piers or other supports cannot be built. The bridge itself consists of a continuous rigid girder resting at each end on fixed piers or abutments of the usual kind, and it is supported at intermediate points on piers mounted on pontoons floating at a fixed depth in the water. The upward force due to the buoyancy of the pontoons must be greater than the downward force due to the weight of the bridge and that of the maximum load it carries.

The pontoons will be submerged at the lowest water level, and they will be held in position by the rigidity of the bridge itself, which also will enable them to resist pressure due to the current. Where necessary, however, the pontoons may be anchored or secured in some other manner. It will be seen that this invention may be regarded as a development of the pontoon bridge, or bridge of boats, used in military engineering, large pontoons that are entirely submerged taking the place of the small floating ones used in building bridges of this type.

Detecting Fire-Damp in Coal Mines

The electric lamps so far employed in coal mines are excellent for light-giving purposes and also are safe, for the glowing wire is hermetically sealed in a glass bulb; but they have the defect that they give no indication of the presence of fire-damp, the gas that may be ignited by a flame or an accidental light to cause a disastrous explosion. In this respect they are inferior to the old style of miner's safety lamp invented by Sir Humphry Davy, in which oil is burned, the flame being enclosed in wire gauze through which it cannot pass. When such a lamp is taken into a fiery mine, the gas passing through the gauze burns inside the lamp with a faint ghostly flame, forming what is known as a "cap" to the flame of the lamp, and the height of this cap is a measure of the proportion of explosive gas present.

A new form of electric amp has now been introuced that may be used in detecting fire-damp. On top of it a small oil lamp fitted with wire gauze is mounted, and this may be lighted by means of a filament heated by current from the accumulator that forms part of the electric lamp.

In making a test with the new lamp for the presence of explosive gas, the electric light is switched off and the oil lamp lit by pressing a switch. The height of the flame is carefully adjusted by means of screws provided for the purpose, and examination of the cap then shows if a dangerous proportion of fire-damp is present. The powerful electric light from the lamp may be used when inspecting the workings in order to detect weaknesses that may lead to roof falls. Thus the new lamp combines the advantages of both types. It is made by Ceag Ltd., Barnsley, to whom we are indebted for the photograph and diagram reproduced on this page.

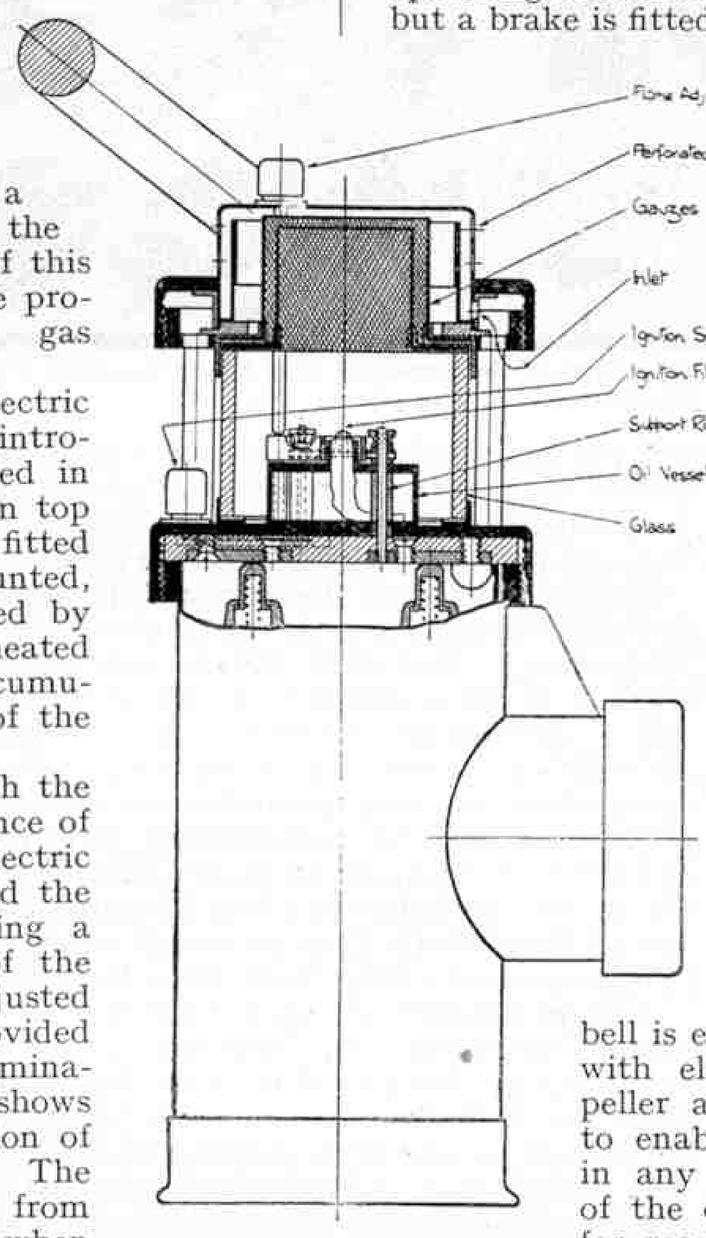


Diagram showing the construction of the new Ceag oil-electric lamp.

A Novel Motor Roller

A motor roller in which the engine is carried in the roller itself has been introduced. This has the advantage that the entire weight of the engine is concentrated on the centre line of the roller, where its effect is greatest; and in addition the complicated external arrangements of motor rollers of the ordinary type are unnecessary.

The engine employed in a motor roller of this type weighing 12 cwt. is of about 2 h.p., and one of 3½ h.p. is sufficiently powerful for a roller weighing 16 cwt. The power is transmitted through a flexible coupling and reduction gearing, and the reduced speed shaft drives the roller by means of friction wheels. The handle acts as a clutch, for bringing it down on each side causes the friction rollers to make contact and to propel the machine away from the man holding it. When the handle is upright the engine is not in gear.

Speeds ranging from ½ m.p.h. to 3 m.p.h. may be attained with the new roller. The only controls required are the levers operating the carburetter and the ignition, but a brake is fitted to the larger machine, and if required also may be installed on the smaller one. Parts of the engine needing frequent adjustment are readily accessible, and when necessary the engine itself may be removed from the roller in a few minutes.

The Ceag combined electric and oil lamp described on this page.

Diving Bell to Work at Depth of Two Miles

A diving bell for use at a depth of nearly two miles below the surface of the sea has been invented by a German engineer. The bell is egg-shaped and is fitted with electric motors, a propeller and a rudder in order to enable it to move readily in any direction on the bed of the ocean. It is intended for recovery of treasure from wrecks, to which it can attach lines by means of electrically-operated pincer-like claws, but it is expected to be useful also in laying and repairing submarine cables.

The new form of diving bell has a double shell, the intervening space containing liquid air that may be heated to generate pressure, for the inventor claims that this may be adjusted to counteract that of the water on the outer shell when working at greater depths. Within the bell are two compartments, one of which contains the electric motor driving the propeller. This obtains current from a vessel on the surface and gives the bell a speed of about two miles an hour. The second compartment is for the diver, who is supplied with a telephone to enable him to keep in touch with the parent ship, and it also contains measuring apparatus in addition to the control gear. Air is pumped into the bell from the surface, but cylinders of oxygen are carried for use in emergencies. If the operator is put out of action an automatic signal reaches the vessel above and the bell may then be brought to the surface by releasing ballast, the controls being placed in the parent ship to avoid disaster after an accident to the diver.

Novel Method of Cooling Pistons

An interesting method of cooling the head of the piston of an internal combustion engine has been invented. In this a suitable chemical, such as nitre, is placed in a sealed chamber in the head of the piston. The melting point of nitre is about 300°C., and it remains solid until the engine has been running for a short time. When it melts, it splashes about in the cavity and conveys the heat away from the piston head to the walls of the cylinder. Thus the temperature of the portion of the piston nearest the explosion is kept lower than in engines not provided with this method of cooling.

The piston employed by the inventor of this means of cooling is made of a light alloy of copper and beryllium, the percentage of beryllium being about 13.

Low Pressure Tyre to Replace Motor Car Wheels

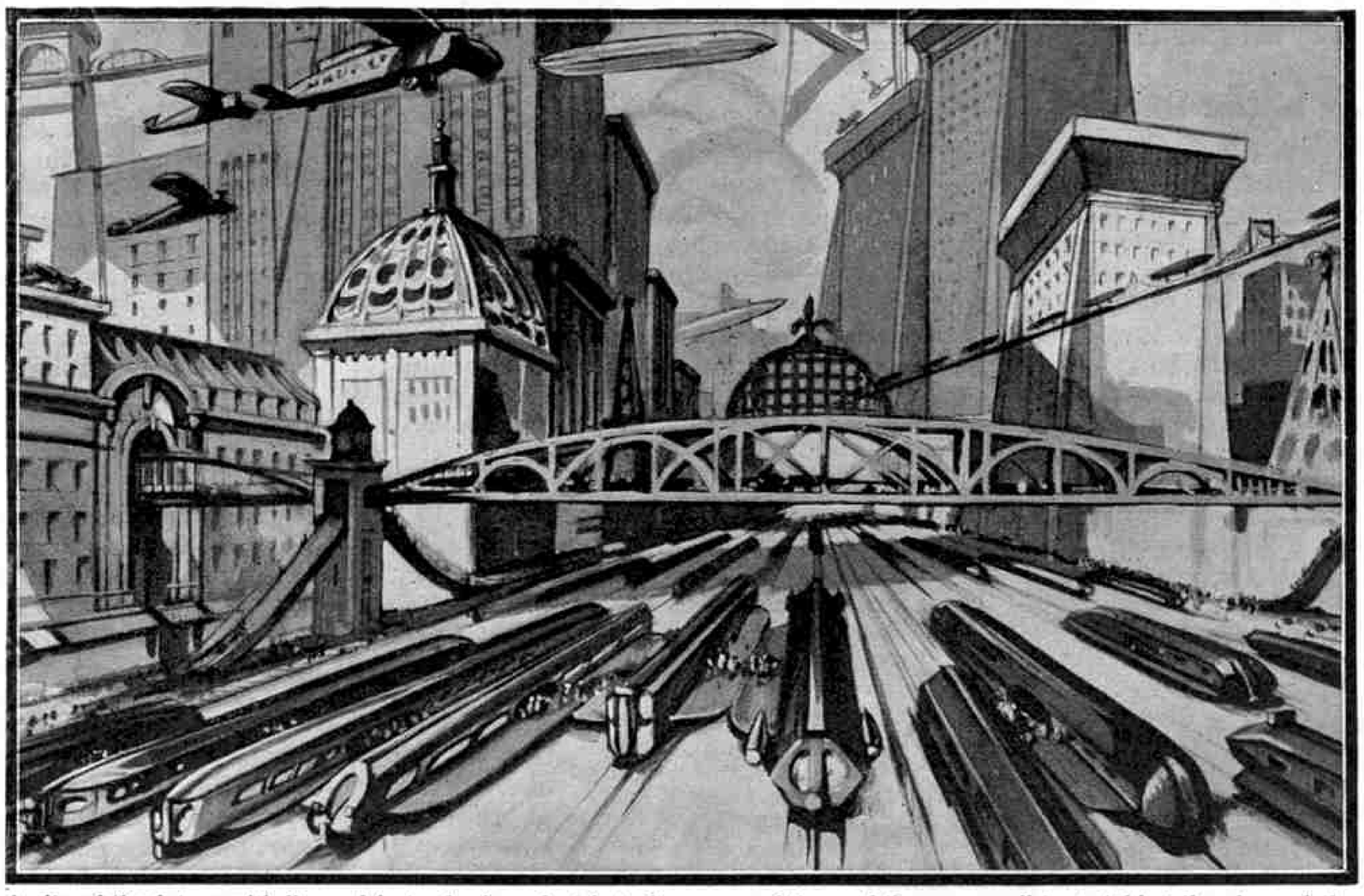
A new low pressure motor car tyre, to which the name of "air wheel" has been given, has been introduced by the Goodyear Tyre & Rubber Co. It is on similar lines to the Goodyear Aeroplane tyre that has been in use for aircraft for about two years with the official approval of the Air Ministry, and is really a substitute for the road wheel, for it is so large that it is mounted directly on the hub. The pressure within it may be as low as 10 lb. per sq. in., and the tyre surmounts small obstacles, such as kerbstones, with much less shock than is experienced when a hard tyre pumped to a high internal pressure is employed. A great advantage of the use of the new tyre is that it grips the road over a large area and thus the risk of skidding and side-slipping is reduced.

The Future of Engineering

Vast Areas of the World Still Unconquered

THE progress made in engineering during the past century has been so great that it seems scarcely possible that it can be maintained. Most of us are surrounded by such a mass of engineering achievements of all kinds that we are apt to overlook the fact that in spite of all these developments the engineer has had little opportunity of influencing the world as a whole. In a few countries his work is visible everywhere and his influence has been enormous. But with the exception of the United States these are mainly comparatively small European countries and there are enormous areas of the surface of the earth where one may travel for hundreds of miles without seeing anything but the crudest specimens of man's handiwork. Areas of this kind are to be found in crowded countries such as China as well as in the barren wastes of the Arctic and the Sahara Desert.

There is undoubtedly scope for an enormous extension of the activities of the engineer, even in the most unpromising regions. For instance, in many vast stretches of country the inhabitants until recently were dependent for water—the first necessity of life—on an uncertain and fluctuating supply from wells and streams. Today this is all changed. Huge reservoirs have been constructed and dams erected across the beds of rivers making it possible to maintain an ample supply of water in even the driest seasons. Difficulties due to climate and local conditions have been successfully overcome and the water retained by the gigantic dams has been turned to good use in reclaiming desert areas and in preventing fertile ground from being wasted for lack of water when the rains failed. It is interesting to note that these gigantic schemes have been carried out by British engineers.



A city of the future with lines of fast suburban electric trains, some of them of the mono-rail type, taking the place of the motor traffic of the present day.

Similarly the improvements in the means of transport that have been developed on each side of the north Atlantic Ocean are being extended slowly to other parts of the world. The advent of the steam locomotive in any new country necessitates the building of bridges, and the boring of tunnels; the arrival of the motor car demands the construction of roads; and with the coming of the aeroplane arises the necessity of providing safe landing grounds.

Although engineers have been busily engaged in the necessary work to meet these demands an observer looking at the Earth from the outside would not be greatly impressed by the results. In a few countries he would see the means of production, machinery, railways and shipping well developed; in other countries he would see the beginning of efforts to supply this demand; but elsewhere he could not fail to be struck by the fact that millions of people are still dependent for their living on the almost unaided efforts of their own hands.

It is the task of the engineer to alter this and there is no doubt that the bulk of his work in the immediate future will be expansion. Railways and roads will spread in all directions in fertile lands to enable the inhabitants to dispose of their produce. Manufactures will follow and the rivers will be harnessed to generate electric power on a vast scale.

As a result of this extension a large demand will certainly arise for materials for the building of bridges, the construction of dams and other works, and eventually this will lead to standardisation of parts and practically to mass production.

Take bridge-building for example. At present the building of great bridges, such as those recently erected to span Sydney Harbour and the Hudson River at New York, is the work of years. When the site and the design of a bridge have been finally settled it is usually necessary to erect special workshops in the neighbourhood and often also to devise new methods and machinery to facilitate the work. Compare this with the task of building a new railway bridge over a narrow country road. Girders and plates of the required size are transported to the spot, and at the appointed hour workmen commence to demolish the old bridge and to place each portion of the new bridge in position. Everything is then made secure and in a few hours trains once more may pass over the bridge, which may be said to have sprung into existence ready-made.

Why should not this be done with any bridge irrespective of size? The chief forms of design are by this time well known and understood, and it is surely not too much to hope that some bridge-building genius will devise systems of construction that will enable any bridge to be built up from easily made standard parts just as models of them may be built up from standard Meccano parts.

The suggestion of the application of mass production methods to bridges as large as, say, the Quebec Bridge over the St. Lawrence River may, at first sight, appear somewhat absurd. It is true that there is no great demand at present for large bridges of this kind, and a commercial traveller carrying samples of them would do well if he made one sale in ten years! Further, the cost of laying down plant to make the necessary standard parts would be very great. It must be remembered, however, that exactly similar objections were made to Henry Ford's schemes when he entered the motor car industry; but he persevered because he was convinced that standardisation would mean price reduction and that in consequence a huge market for his cars would be created.

A little thought will show that there is still enormous scope for bridge-building even in Great Britain. For instance we find South Wales cut off from south-western England, Kent from Essex, and East Yorkshire from Lincolnshire by waterways that easily might be bridged nearer their mouths than at present. It is probable that Yorkshire and Lincolnshire will shortly be connected by means of a bridge across the River Humber. This will be about $1\frac{1}{4}$ miles in length, and as the Humber is used by large sea-going vessels, the deck of the proposed structure will be at least 90 ft. above high water level. It is interesting to note that a similar scheme

has been suggested on the west coast, where at present the estuary of the River Dee makes necessary a detour of about 25 miles when travelling between Liverpool and North Wales.

The Bennie Railplane may play an important part in developments of this character, for the cost of erecting the necessary elevated track across the estuary of a river would be much less than that of building a bridge. In fact, a proposal has already been made to construct a Bennie Railplane along the Lancashire coast. This would run from Liverpool to Southport and Blackpool, and its course would take it across the shallow waters at the mouth of the Ribble.

Another important point is that as a rule bridges are not erected until they are absolutely forced upon us. A world governed by wise engineering principles would foresee the necessity or the advantages to be gained and would proceed to build with the aid of standard parts. It is because the line of the Canadian Pacific Railway was carried across the continent before necessity compelled its completion, and in anticipation of succeeding developments, that this railway deserves to rank as one of the greatest engineering developments in the world.

Standardisation of parts would be made easier by the introduction of new building materials. At present we are living in the age of iron but in many respects iron is an unsatisfactory metal. It is used on such an enormous scale in industry and in constructive engineering because we do not know a more suitable metal, but it has the great drawback of being easily corroded and rusted. It has been calculated that the annual loss from rusting and corrosion amounts to no less than £500,000,000, and yet the only practical method that has been available until recently for protecting iron from rusting has been the liberal use of paint. The comparatively recent introduction of rustless steel may possibly put an end to this waste and maintain the present position of iron as the world's primary structural metal. Rustless steel is really an alloy containing about 13 per cent. of chromium. It is resistant to most forms of corrosion and is likely to find an increasing number of industrial applications such as in hydraulic pumps, and in dock, bridge and ship construction.

Another important point in connection with the use of iron is that there is a limit to the amount of the metal available. A well-known geologist has stated that if the world's consumption of iron continues to increase at the same rate as before the War, the supply of ore probably will be exhausted within 130 to 150 years. This suggests that the time is approaching when a substitute for the metal must be found.

The skyscraper cities of the future will not be ugly. Their iron and concrete buildings will be at once graceful and useful, as this photograph of the City Hall of Los Angeles shows.

It is difficult to say what new metal or alloy will be developed to take the place of iron and steel. Aluminium or magnesium may come into extensive use in some form or other, as alloys containing them combine lightness with other valuable qualities, and research work may result in the production of alloys having the necessary strength.

As far as reservoir and dam construction and, in a less degree, bridge-building are concerned, the use of reinforced concrete makes standardisation comparatively easy. Ferro-concrete blocks of standard sizes may be made without any difficulty wherever they are required, or alternatively concrete may be poured directly into its final position by making use of standard moulds. This method has been introduced already in America where it is employed in the erection of the huge buildings for which that country is famous. Another interesting and important feature of concrete is that its introduction will help in conserving the supply of iron. A considerably less amount of the metal will be required and in addition it will be protected by the concrete in which it is embedded from the corroding effect of moist air.

The future of engineering must be looked at also from another point of view. The great extensions to which we have referred will not only call for a larger number of trained engineers than are to be found at the present day but will result also in a much more intense study of the science. This study will be carried on by generations that will be more familiar with engineering methods than the present generation, and we may note in passing that the growing tendency to think in engineering terms is being strongly encouraged by familiarity with the Meccano system of miniature engineering. This study, together with research on the composition and properties of materials of all kinds, will undoubtedly lead to the discovery of new principles and the application of old principles in new forms.

The engineers of the future will be greatly concerned in the developments that will follow the inevitable increase in the speed and volume in vehicular traffic on roadways that will bring about a dangerous condition of affairs to cope with which two-way traffic will be abolished in favour of the "one track, one direction" method in use on the railways.

Another interesting point concerns the fight between the rubber-tyred wheel and the wheel designed to run on rails. The struggle will probably be won by the latter, for two reasons. In the first place, the population of the Earth will undoubtedly increase so greatly that there will be no space left available for rubber plantations, every possible acre of ground being required for food-producing purposes. Secondly, the future development of light alloys already referred to will make the production of rails and metal wheels on a large scale a comparatively easy matter.

The victory of the rail will be accompanied by the abolition of the double rail in favour of the single rail with streamlined mono-cars balanced by a gyroscope. The rails on which these cars will run will vary considerably in size to suit varying weights of traffic and an elaborate network of them with properly constructed junctions will cover the country in all directions. The private owner of a mono-car may have rails leading from his garage to the public rails or if he has not, he will be able to place his car on the latter quite easily, as its metal parts will be made of some light alloy and the remainder would be constructed of fabric of little weight.

The provision of power is one of the chief cares of the engineer, and in this direction great changes undoubtedly will take place in the next few centuries. The time will come when neither coal nor oil will be available, and it will then be necessary to fall back on such sources of natural power as waterfalls, and probably efforts will be made to make greater use of the power of the tides and winds.

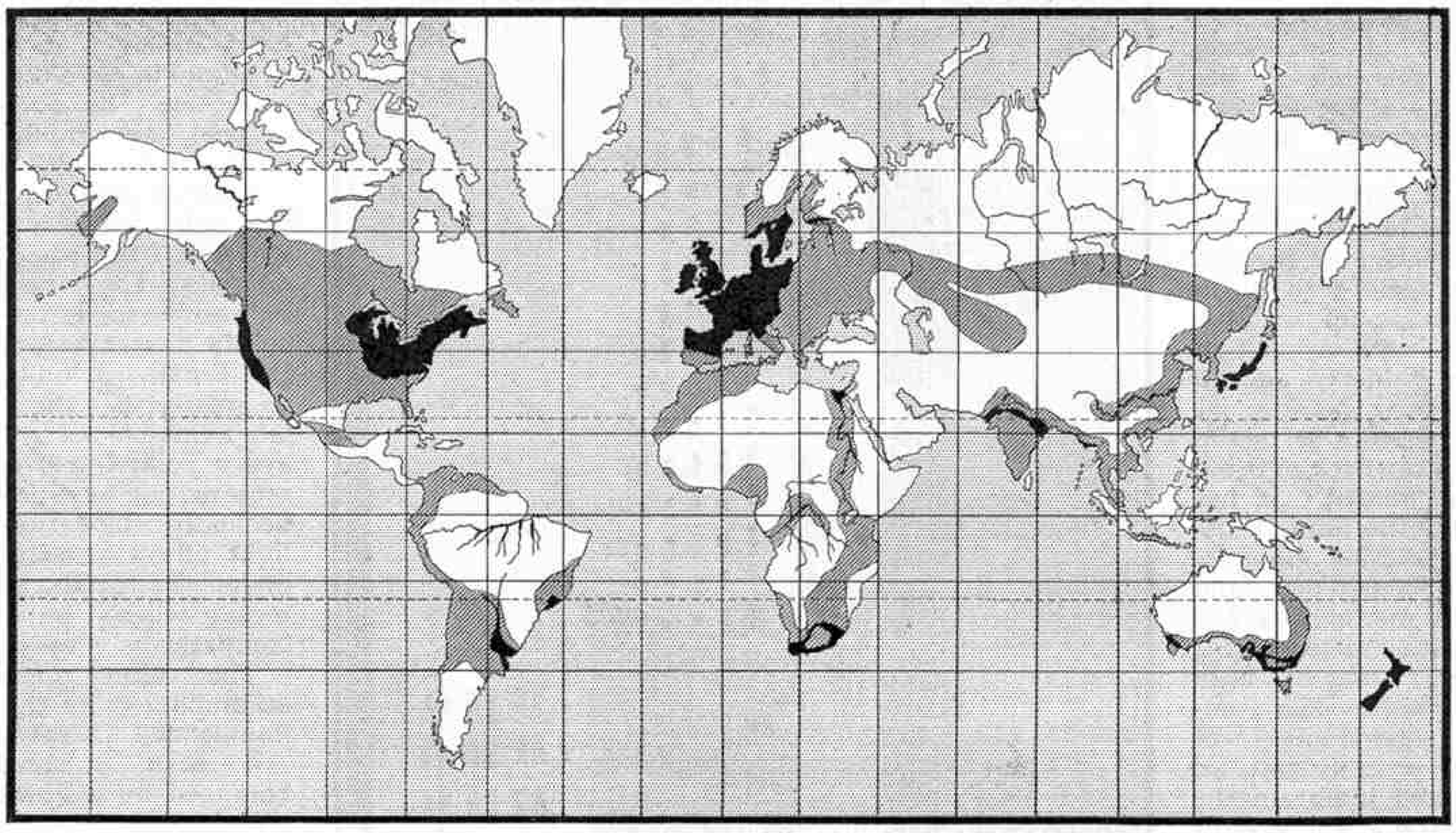
It has been suggested that enormous power may be obtained from the disintegration of atoms. It is quite true that the temperature of a piece of radium is higher than that of its surroundings. This metal and its compounds radiate energy for incredibly long periods, but unfortunately it is rare, and in any case we cannot control the flow of energy that proceeds from it. It may eventually be found possible to release the energy contained within the atom by breaking it np, but it is doubtful if any would be available for use, for present indications suggest that more energy or power would be required to decompose them than would be set free. One method of breaking up atoms that has been suggested is that of bombarding them by electrons shot off at terrific speed from the cathode, or negative electrode, of a vacuum tube. From the point of view of a power engineer this is scarcely a practical proposition, for vacuum tubes of the size required are extremely

costly and difficult to manipulate.

It may be noted that we do actually make use of the energy of disintegrating atoms, for this source of energy seems to play a great part in maintaining the temperature of the Sun. To make use of it directly is another matter altogether. At present it may be said that the cost of producing power by the breaking up of atoms by means under human control is about 100,000 times the gain. The break-up of atoms of aluminium may be taken as an illustration of this. This metal would yield the inflammable gas hydrogen on bombardment with the rays from radium. But if the rays from the entire stock of radium in the world were projected into a sheet of aluminium for the next seven years, only one cubic millimetre of hydrogen would be produced. We can find better uses for radium than this.

Summing up, it may be said that the two things that the engineer calls for in all circumstances are ample supplies of improved materials and power. We have seen how these wants will probably be supplied, the former by standardisation and research on non-rusting metallic alloys, and the latter by making more direct use of the Sun's heat. With his resources thus increased, the engineer will continue to play an increasingly important part in life.

In future we shall live in cities that will be planned and erected by engineers, who have already invaded the building world in America. The great heights to which the steel and concrete erections of American cities have been taken is a measure of what will be done throughout the world as the population increases.



On the above map the black areas show where the engineer has been at work for a considerable period and the shaded portions indicate where he is now penetrating. The lands left white have not yet been developed.

Already there are nearly 500 buildings having more than 20 storeys in the city of New York, and these include nearly 100 that have at least 30 storeys. At present the world's highest skyscraper is the Empire State Building which is 1,250 ft. in height, but in Chicago, Los Angeles, Detroit, Philadelphia and Boston huge structures are being erected or planned, and it is possible that even the Empire State Building will be surpassed in a few years' time. The growth of giant buildings is a feature of the past 50 years, for in 1880 skyscrapers were entirely unknown in America.

A high degree of efficiency has been attained by architects and builders, and it is interesting to note that standardisation of methods has been introduced, with the result that a 33-storey skyscraper about 740 ft. in height may now be erected in the short time of 93 days!

The difficulty of supplying clean fresh air to those who live and work on the lower floors of the great buildings will be solved by the use of carefully planned ducts through which filtered air will be supplied, while lamps that radiate a scientific blend of infra-red and ultra-violet rays in addition to the usual light rays will be more beneficial to them than sunlight itself.

The continued increase in the number of people per square yard in crowded business and residential areas will also make the provision of overhead means of transport necessary, as may be realised from the fact that if the Woolworth Building and other skyscrapers on Manhattan Island in New York discharged all their occupants at once there would not be standing room for them in the streets in the immediate vicinity. The buildings of the cities of the future will therefore be connected by bridges at various heights for foot and vehicular traffic so that it will not be necessary for all their occupants to follow the same route in entering or leaving.

High-speed escalators will be provided, in addition to express lifts, and if the occupant of an office on the fiftieth floor of a building near the Bank of England in London gets tired of travelling to his home north of Hampstead on the mono-rail cars that run through the city at different levels, he may proceed by a series of escalators that take him north while bringing him nearer the ground.

A suggestion of this kind has already been made quite seriously in Chicago, a go-ahead American city that promises to produce many splendid ideas in the future. It has been proposed to erect a line of skyscrapers along the Lake Michigan frontage of that city, with the tallest buildings in the middle of the line, the heights decreasing towards the ends. The tops of these buildings will be bridged by a roadway, along which those who work in the buildings will pass on arrival or departure, while they will leave their cars during the day in the garages arranged on the uppermost floors. A scheme of this kind will relieve congestion of traffic in the streets and thus prevent waste of valuable time.

The engineer will also rule in factories and in agriculture. In the former he will find new methods of carrying out the fundamental processes, and he will be greatly assisted in this work by the results of a more scientific study of lubrication as well as by the new alloys that the metallurgists will produce. Agricultural machinery is in special need of improvement, but at present the lack of power prevents developments. Both steam-engines and petrol motors are being used more frequently, but the complete mechanization of this industry will not become possible until cheap electrical power is widely distributed.

The last place in which power on any comprehensive scale will be introduced is the home, but in the days to come power will be so cheap in comparison with human labour that the latter will be displaced almost universally. The homes of the future will differ greatly from those of to-day, for the engineer will unite with the architect and builder in designing light and airy structures in which the occupants will be comfortable and healthy. Electrical devices will not only do all the work, but will provide heat as well as light at night, thereby saving the expense and inconvenience involved in the upkeep of fires. Electrical power generated at central stations will be employed for heating purposes, of course, but instead of glowing radiators, wall panels warmed by the passage of the current through wires will be employed. The panels will not be hot to the touch but the heat radiated from them will be sufficient to maintain a comfortable temperature in the rooms, and the current will be controlled automatically, being cut off when the temperature rises too high and switched on when it falls below the minimum allowed. All that the occupants of the room will have to do will be to set the regulator in accordance with their requirements. The efforts of the engineer also will be productive in many other directions, for in addition to his utilitarian work he will join forces with others to give practical expression to many ideas and discoveries that will add greatly to the enjoyment of life and increase the general standard of comfort.

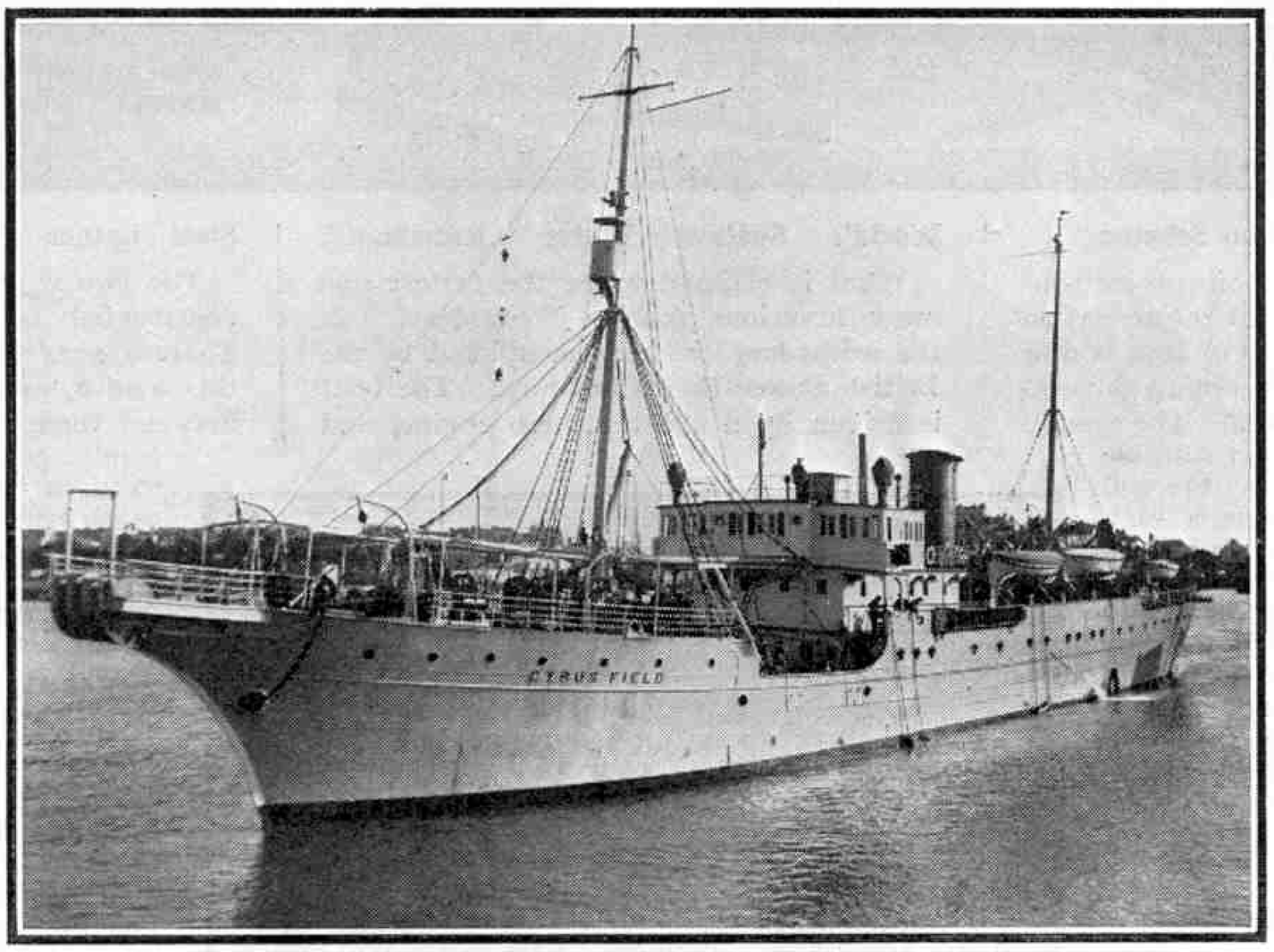
This brief summary of the engineering of the future is necessarily incomplete. In 1828 George Stephenson was in a position to visualise the great changes in transport methods that the introduction of the steam engine would bring about, but he would have been quite unable to foretell the introduction of the petrol engine, and of electric lighting and power. Similarly, principles that to us would be new and startling will almost certainly be commonplace features to the engineers of the future, who are the Meccano boys of to-day.

Repairing Submarine Cables

Some Curious Causes of Breakdown

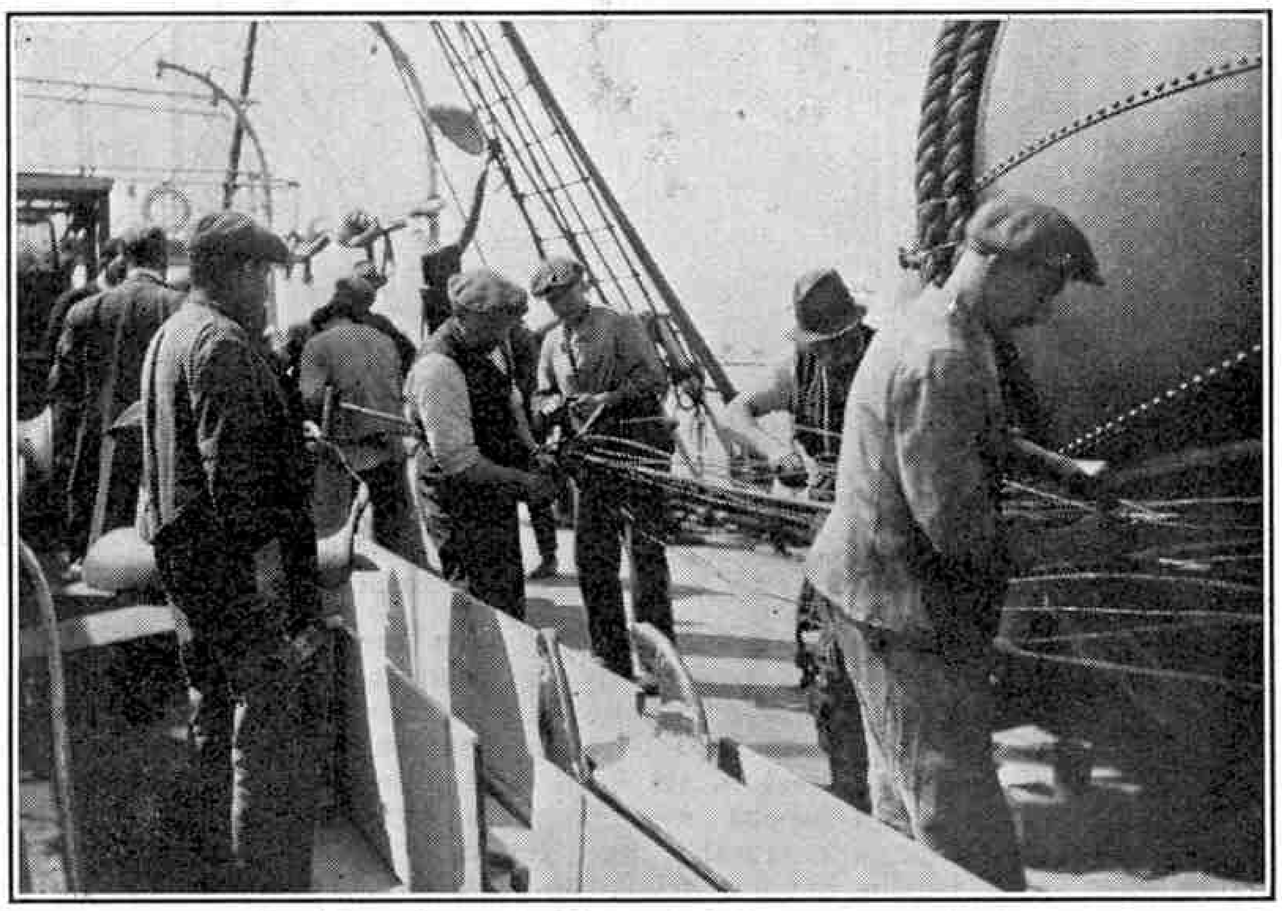
HOWEVER well a submarine cable may be manufactured and laid it is always liable to injury and breakdown. The danger of injury is of course much greater near the shore than at great depths, for below a depth of a very few fathoms there is no movement of the water even when the severest storms are raging on the surface. Close to shore, however, a sandy sea floor is often moved considerably by the force of a storm, and whatever is lying upon this sand is moved also. Consequently, when a severe storm occurs, the portion of a cable close to land is likely to be damaged. On rocky coasts also the cable is liable to constant chafing, which eventually wears through the insulation. In addition, shallow water cables are liable to damage from ships' anchors or fishermen's trawls becoming entangled in them.

Even in the deepest water, however, the cable is exposed to danger. For instance, a great storm may send a fine ship down to find its last resting place across a cable. Off the west coast of Ireland, where many trans-Atlantic cables converge, and where during the War German submarines were very active, repair ships grappling for cables that have failed have on various occasions hauled up funnels and other parts of wrecked ships.



The twin-screw, oil-burning steamship "Cyrus Field," specially built for cable work.

In northern waters icebergs grounding on shoals often grind the cable flat, thus exposing the conductor or severing the cable entirely. On one occasion a repair ship hauled up the dead body of a whale entangled in loop after loop of cable. Thus was disclosed a tragedy of the deep that had ended, as might be expected, in the parting of the cable during the huge creature's death struggle. At another time a shark, evidently thinking he had found something new to devour, ventured to attack a cable. He took a good bite, but found that the gutta-percha insulation held his teeth in so firm a grip that he was compelled to leave one of them behind. Although the shark escaped with only the loss of a tooth, his bite had been sufficiently severe to allow the water to reach the conductor, and to cost the owners of the cable several hundred pounds in effecting the necessary repair.

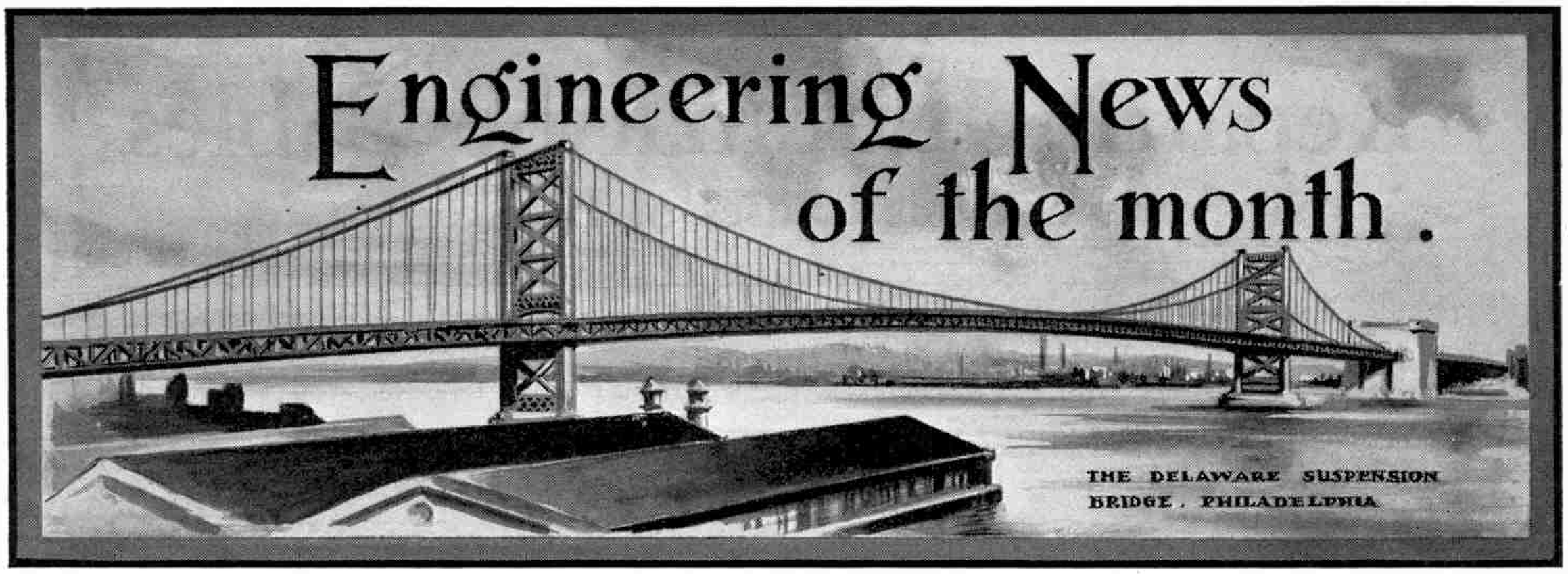


Repairing a damaged cable; a typical scene on a cable ship.

When a break occurs in a cable, strenuous efforts are made to repair the damage as quickly as possible, as the interruption of a busy cable is of serious consequence to those who use it, and involves heavy loss of revenue to its owners. The exact position of the break is ascertained by electrical methods, and a cable repair ship is hurried to the spot. On arriving at the point where the cable is to be picked up, the repair ship puts an anchored buoy overboard to mark the point of departure, and then steams backward and forward across the line of the cable, dragging a grapnel over the sea floor. The grapnel rope passes over a dynamometer, which gives an immediate indication when the grapnel has caught the cable or some obstruction, and the strain on the grapnel is then at once relieved. When the cable has been hooked, it is lifted with the utmost care, the dynamometer indications being watched continuously in order that an undue strain may not be put upon the cable. As soon as the cable has been safely brought up, repair operations are commenced. These may consist of an actual repair, or the cutting out of a portion of the cable and the insertion of a new length. If the latter course has to be adopted the cable is cut and one end is dropped, fastened to a mark buoy to enable it to be recovered readily for joining up when the repair is complete. After the repair is made the cable has to be lowered to the sea floor with exactly the same precautions in regard to undue strain as were taken in hauling it up.

The time taken to effect a repair depends very largely on the weather. It is only in almost ideal weather that work can proceed satisfactorily, and if unfavourable conditions prevail many weeks or even months may elapse before the work can be completed.

In the early days of cable laying ordinary steamers were chartered and temporarily altered, but to-day there exists a fleet of fine vessels designed exclusively for cable work. Our upper illustration shows the cable ship "*Cyrus Field*," named after one of the promoters of the first Atlantic cable. This vessel, which is owned by the British Western Union Ltd., was built in 1924 by the St. Nazaire Shipyard. She is a steel twin screw steamship fitted for oil fuel, and is 223 ft. long, 34 ft. broad and 16 ft. deep. Cables for repair are hauled over the specially designed bow.



Nile Delta Reclamation Scheme

An ambitious reclamation project involving the improvement of the irrigation of about 2,000 square miles of land is now being carried out by the Egyptian Government in the delta of the Nile. The ground in this region is not naturally suitable for agricultural purposes, as the soil is very sandy and contains a high percentage of salt. At present fresh water canals supply water to the area to be dealt with, and as this percolates through the soil it dissolves the salt and carries it down to drains, along which it passes either to the sea or to lakes in the vicinity. This method of irrigation is effective, but the water flows very slowly because the differences in level are small.

Under the new scheme, 15 pumping stations will be built near the mouths of the drains and, by lowering the level of the salt-laden water in these, they will greatly accelerate the circulation of fresh water from the canals.

The equipment for the pumping stations has been provided by Metropolitan-Vickers Electrical Co. Ltd. Current to operate them is to be generated in three power houses connected by means of an overhead transmission system. At first it will be transmitted at 33,000 volts, but provision has been made to enable this to be increased to 66,000 volts if a higher voltage is thought desirable at any time in the future.

Thirteen outdoor switching stations have been installed to control the branch lines to the pumping stations, and arrangements also have been made to enable the transmission line to be tapped if necessary in order to supply energy to towns in the neighbourhood. The transmission line is in seven sections, each of which may be completely isolated.

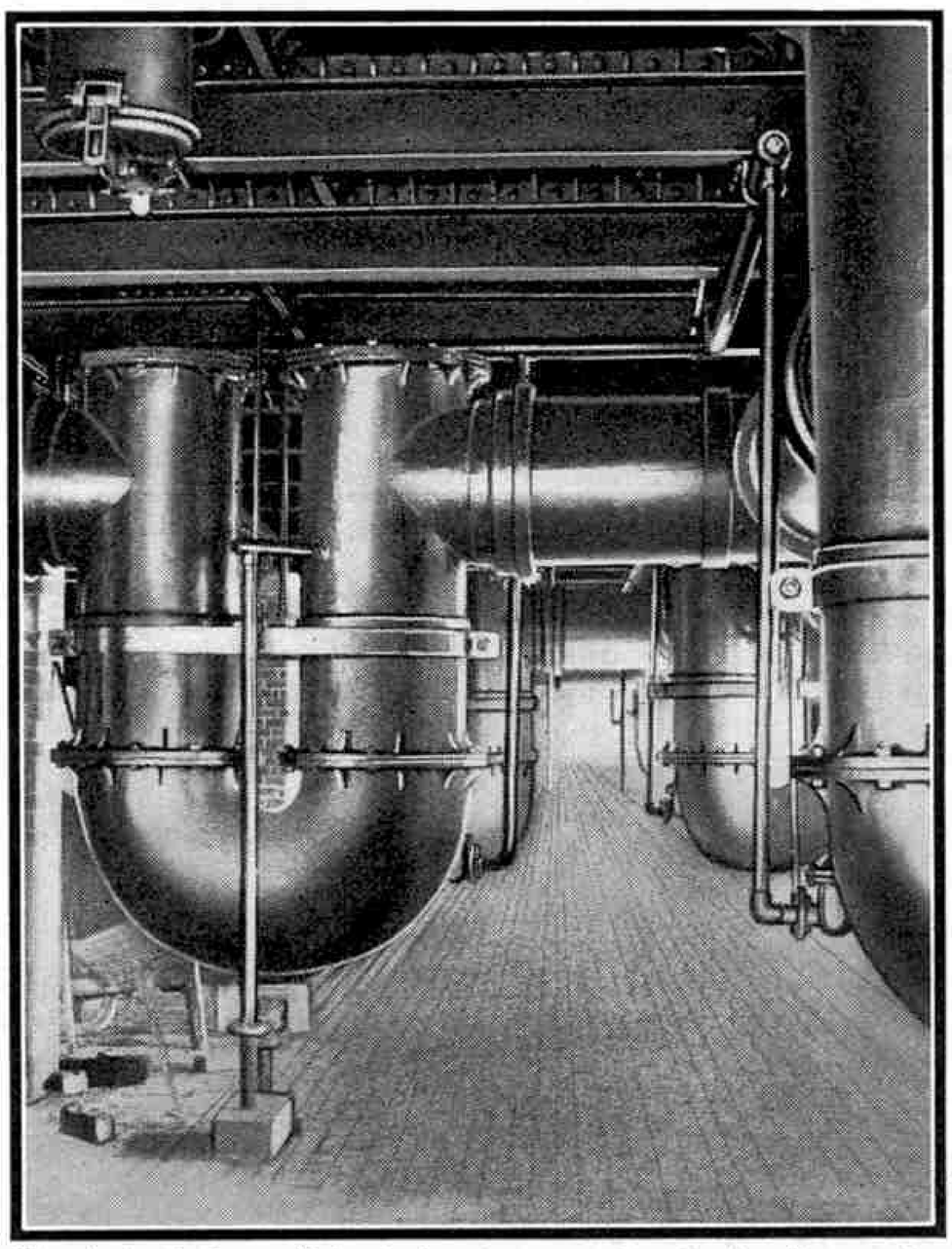
World's Largest Quarry Blast

The enormous quantity of 220 tons of dynamite was recently exploded in what is claimed to be the largest quarry blast ever fired. This great explosion was carried out in a quarry near Manistique, Michigan. The dynamite was distributed in 4,030 holes, each six in. in diameter, drilled over a surface measuring 4,400 ft. by 200 ft., and it is estimated that the blast displaced more than 1,200,000 tons of rock.

World's Swiftest Water "Runabout"

What is claimed to be the fastest and most luxurious marine "runabout" in the world has just been completed by the British Power Boat Company. The boat is driven by a 500 h.p. aero engine, and has been designed for use as a tender to a yacht owned by a Continental millionaire, one of the stipulations of whose contract was that the boat should be the fastest of its kind in the world. Only 15 weeks were available for its design, construction and testing.

During her first trials the boat travelled at a speed of more than 50 miles an hour at half throttle, and when fully run in she is expected to be capable of a speed of 60 or 70 m.p.h. The boat is fitted with a special design of hull to prevent the spray from coming on board.



View beneath the purifying tanks at a gasworks, showing the massive pipes through which the newly-made gas passes from one tank to another during the final stage in cleansing it from impurities.

Steel Lattice Pylons 478 ft. in Height

The two steel lattice pylons now being constructed on opposite banks of the Thames near Barking will be completed this month, and the distance of 3,060 ft. between them will be spanned by seven conductor wires. These wires will be fixed in two sets of three, with an earth wire between the two groups.

The pylons are being erected in order to carry current from the new power station at Barking to the Northfleet sub-station, from which it will be distributed by means of the south-eastern section of the "grid" system introduced by the Central Electricity Board. Each pylon will be 478 ft. in height, or 132 ft. higher than St. Paul's Cathedral, and they will be the highest towers of their kind in the world. The steelwork of each weighs 290 tons, and their bases are 120 ft. in length and breadth, this distance being much greater than the height of an ordinary "grid" tower. They rest on concrete piles driven into the ground to a depth of 60 ft., and in spite of their immense height they are self-supporting, no stays being required.

The wires crossing the Thames will weigh about 42 tons and will sag 170 ft. At their lowest point they will be 250 ft. above the high water level, however, and thus there will be no danger of fouling the masts of vessels passing up and down the river. In erecting them, the drums on which they will arrive from the cableworks will be placed on a barge moored to the north bank of the river and one end of each wire will be attached to a small pylon. The wires will then be run over pulleys on the top of the large pylon, and the barge will be towed to the opposite side of the river, the wires being paid out into the water as it proceeds. On reaching the southern end the wires will be hoisted to the top of the pylon on that side and there slipped over pulleys. The ends will then be pulled down slowly in order to lift the wire out of the water to the necessary height of 250 ft.

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Designed to accommodate 1,250 passengers, the "*Manhattan*" is the largest merchant vessel ever constructed in the United States. She was put into service on the 10th August last.

New French Liner for Atlantic Service

An important new Atlantic liner has been constructed in France for service between Le Havre and New York. This is the "*Champlain*," a twin-screw, turbine-driven steamship about 642 ft. in overall length. She is 88 ft. in width at the promenade deck and has a displacement of about 28,627 tons. Accommodation is provided for 1,013 passengers in cabins, and a crew of 575 is carried.

The machinery of the "*Champlain*" consists of two sets of turbines. Each set includes a high, an intermediate and a low pressure turbine, and is connected to the propeller by means of reduction gears. The high and intermediate pressure turbines run at 1,900 r.p.m. and the low pressure turbine at 1,500 r.p.m. Normally 24,000 s.h.p. is developed, giving a designed speed of 20 knots, but 25,500 s.h.p. may be obtained with a propeller speed of 127 r.p.m., and during her trials the vessel attained a speed of 21 knots.

Steam for the turbines is provided by six water-tube boilers working at a pressure of 400 lb. per sq. in., superheaters increasing the temperature of the steam to 350°C. The boilers are oil-fired and the vessel's tanks carry 4,450 tons, or sufficient to enable her to carry out a trip to New York and back. An additional 800 tons of oil may be carried as cargo.

Lambeth Bridge now in Use

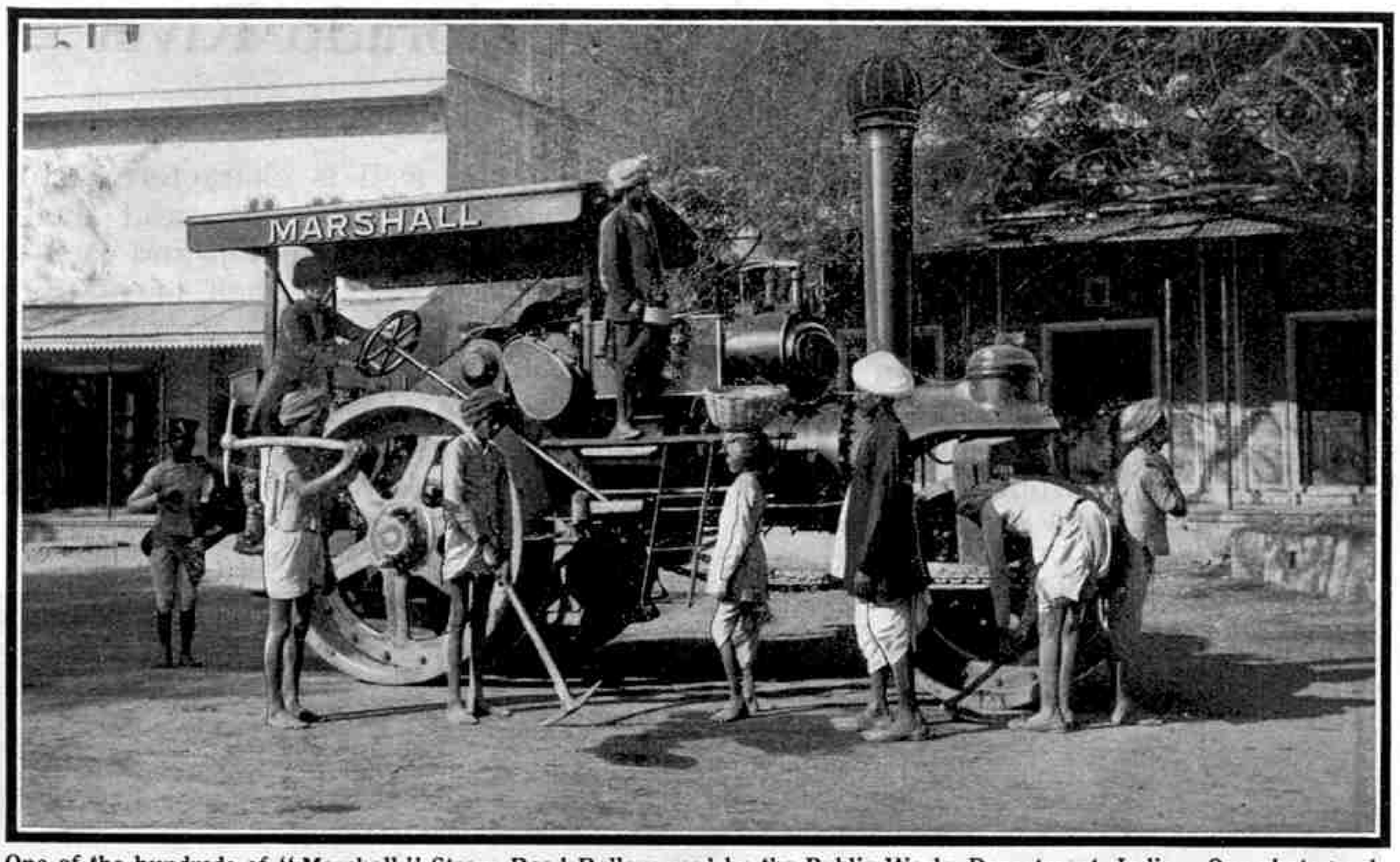
The new bridge across the Thames at Lambeth was opened by the King on 19th July last. The bridge replaces a wire rope suspension bridge built as long ago as 1862-3, and is 776 ft. in total length. It has five spans, the centre one being 165 ft. in length, and the shore and intermediate spans 125 ft. and 149 ft. in length respectively.

The bridge has a total width of 60 ft., and carries a roadway 36 ft. in width in addition to two pathways. More than 4,000 tons of steel have been used in its construction. It is about half a mile above Westminster Bridge, and is expected to relieve traffic congestion at other Thames crossings. This bridge, designed by Sir George Humphreys, has taken three years to construct.

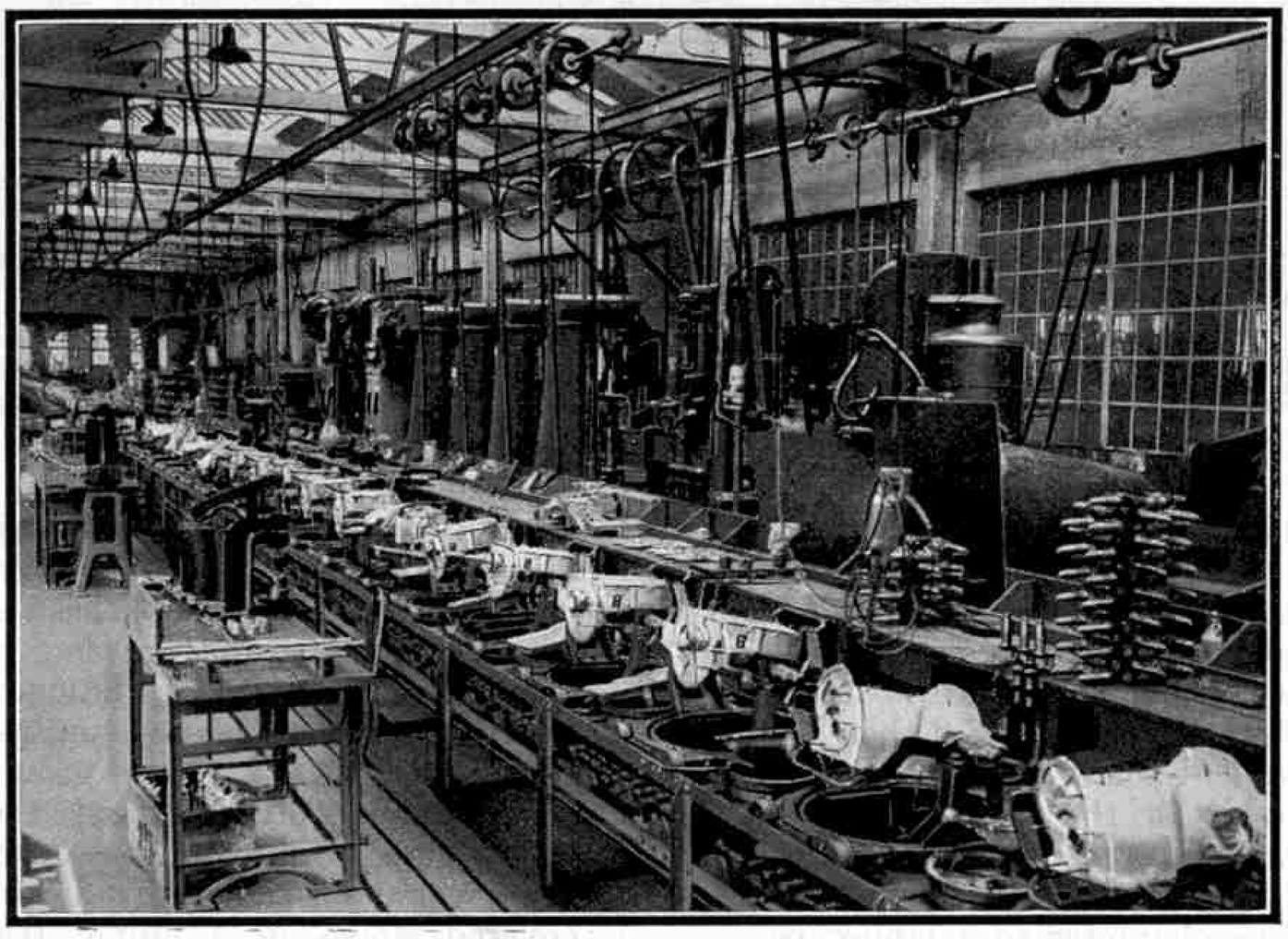
Removing a Factory by Rail

The Great Western Railway recently completed the removal of a factory in full production from London to Chippenham, a distance of 94 miles. The work involved the transport of 750 tons of machinery and the household effects of 36 families, as well as the transference of 100 persons; but it was made without interruption to the business of the firm.

Containers were employed in the removal, and selected portions of the machinery were dismantled at night, conveyed by road to Paddington for despatch by rail to Chippenham, and re-erected in the new factory in time for immediate use next morning. As each machine was taken to the new factory the families of its operators also were removed. Meals were provided while household effects were being transferred.



One of the hundreds of "Marshall" Steam Road Rollers used by the Public Works Department, India. Our photograph is reproduced by courtesy of Marshall, Sons & Co. Ltd., Gainsborough.



In the mass production of motor cars extensive use is made of conveyor belts such as that shown in this photograph. Jigs that can be rotated and pivoted in every direction ensure convenient working conditions throughout.

New Cranes Installed in Middlesbrough Docks

Thirty-seven large cranes of the level luffing type have recently been installed at the Middlesbrough Docks. They were built by Cowans, Sheldon & Co. Ltd., of Carlisle, and are fitted with electrical operating gear manufactured by the British Thomson-Houston Co. Ltd., of Rugby. Four of them are capable of lifting maximum loads of five tons, and the remaining 33 are able to deal with loads weighing up to three tons.

Each crane is provided with four electric motors, a separate one for each motion. That employed for hoisting purposes in the three-ton cranes develops 55 h.p., and smaller motors are used for slewing, luffing and travelling. On the five-ton cranes a 64 h.p. motor is used for hoisting, and three others, of 10 h.p., 8 h.p., and 15 h.p. respectively, are fitted in order to enable the three remaining motions to be carried out. All four motors on each crane are housed inside the operator's cab or control room.

Double-Deck Bridge to be Built in India

A new bridge is to be constructed over the River Jumna, at Delhi, India, in place of an existing structure that carries the line of the Bengal and North Western Railway. The new bridge will be of the double-deck type and will carry a railway line on the upper deck and a roadway below. The bridge will be about 2,600 ft. in length, and will consist of 12 spans each 218 ft. in length. About 5,800 tons of steelwork will be used in the construction.

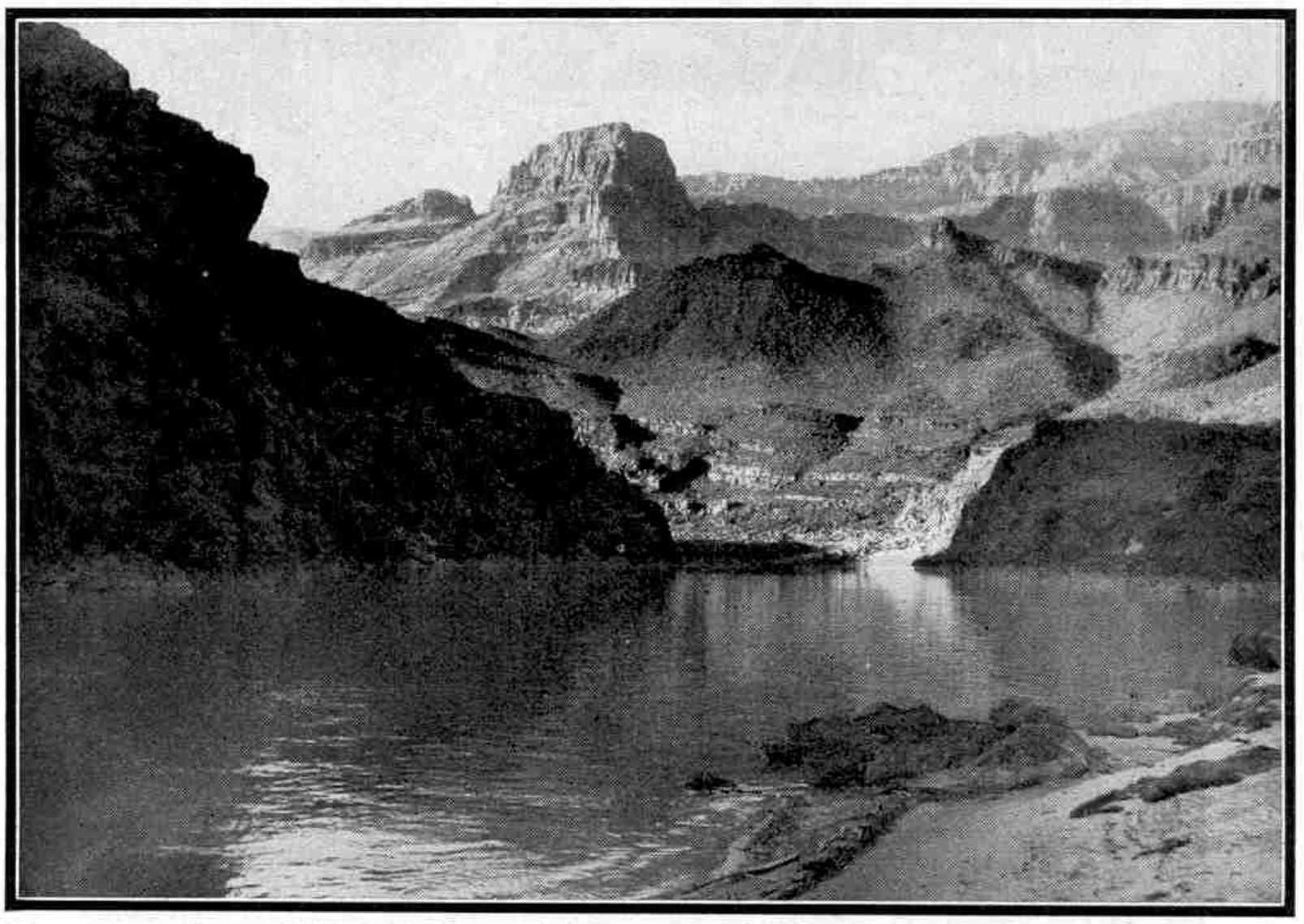
A Giant Oil Circuit Breaker

Metropolitan - Vickers Electrical Co. Ltd. have recently constructed a three-phase, 800 amp., 161 k.v. oil circuit breaker with a breaking capacity of 2,500 k.v.a. This is claimed to be the largest switch of its kind ever built in this country. The tank employed in the breaker is 6.5 ft. in diameter and 20 ft. in height, and has a capacity of 1,830 gallons of oil. Twelve other circuit breakers of similar size and capacity are being manufactured by the company for use in a hydro-electric station abroad.

The Grand Canyon National Park

Mile-Deep Bed of the Colorado River

AMONG the twenty-one magnificent national parks of the United States, which have a total area of 12,118 square miles, the most remarkable from the point of view of unique scenic grandeur is the Grand Canyon National Park in northern Arizona. This park, which was created in 1919, has an area of 1,009 square miles, and encloses 56 miles of the famous Grand Canyon, stretching west of its beginning at the mouth of the Marble Canyon. Through it winds the Colorado River for a distance of 105 miles. From rim to rim the portion of the canyon within the park varies from four to 18 miles in width, and it is more than a mile deep measured from the north rim, which averages nearly 1,000 ft. higher than the south rim.



The water-worn gorges of the Grand Canyon of Arizona, some of which have been eroded to a depth of 6,000 ft. by the ceaseless action of streams and rivers.

The Grand Canyon is one of the world's most marvellous spectacles, and is by far the greatest example of river erosion. It is the deepest, widest and wildest of a long series of canyons through which the Colorado River flow for 500 miles across a region of high table-lands known as the Colorado Plateaus. These canyons are unusually steep-sided and deep, but they are merely parts of the valley of the river and, like most other river valleys, they have been formed by the stream that occupies them. They are not due to any violent disturbance of the Earth's crust, but are the result of the combined action of running water, rain, wind and the various atmospheric agencies that attack the rocks and sculpture them into the forms that give character to a landscape.

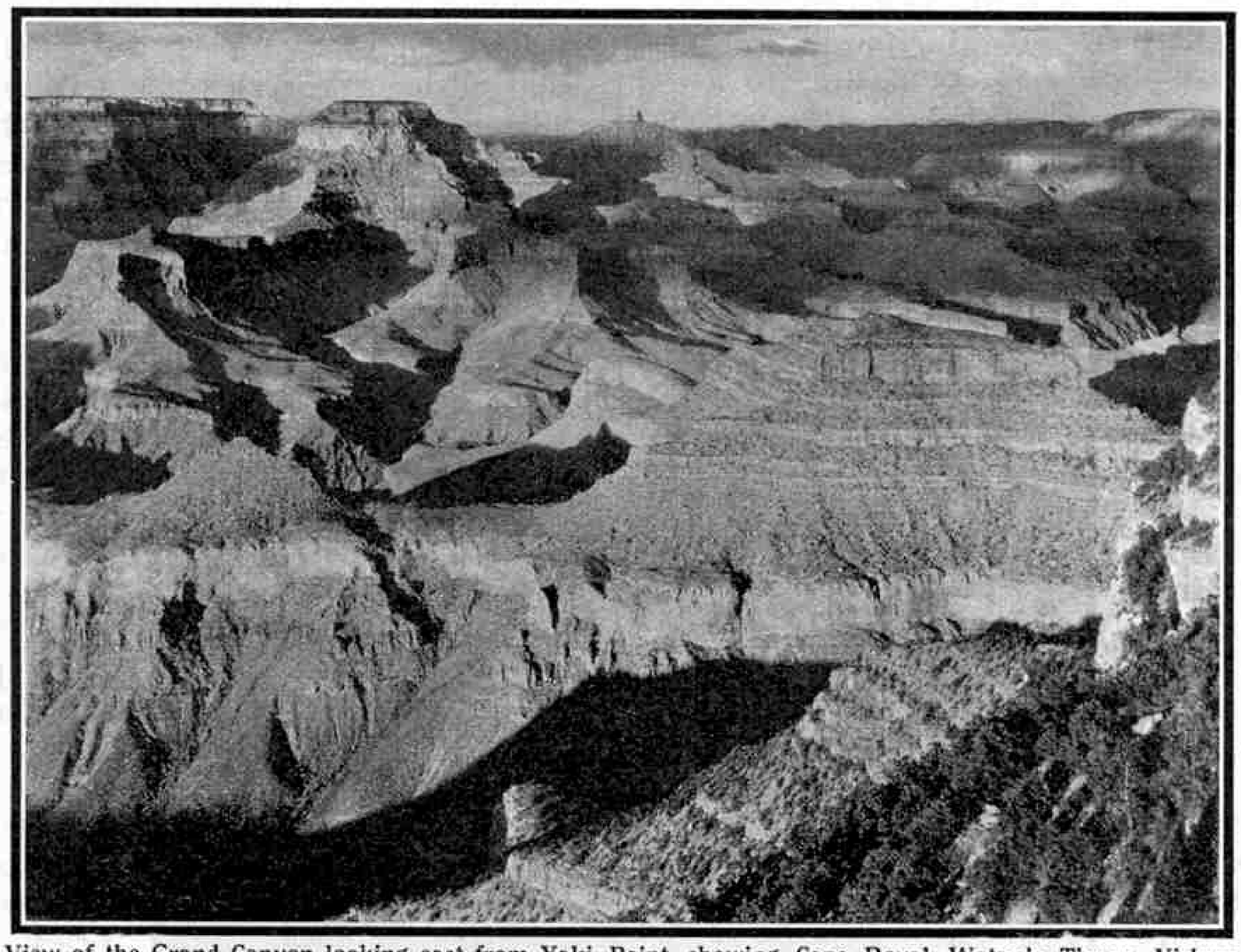
The high plateau into which the river has cut its way is built up of layer upon layer of rock beds that lie nearly level and extend continuously over great distances. These beds, as may be seen in the walls of the canyon, consist of sandstone, shale and limestone. As they lie in orderly horizontal layers, like beds of masonry, they have been carved into definite architectural forms. They vary in their resistance to erosion, some being hard and others soft; and every part of the canyon wall is characterised by its own step-like alternation of cliff, slope and shelf. Each resistant bed stands forth as a cliff, and each weak bed is marked by a slope. Each shelf or platform is made by the wasting back of a weak stratum or layer that lies upon a resistant, cliff-making stratum; and the greater the thickness of the weak stratum the broader the shelf. The plateaus that border the canyon are themselves simply great terraces developed on a resistant formation, from which overlying and softer beds have been washed away. As erosion has gone on, parts of the canyon wall or plateau have become separated by the widening and cutting headward of branch canyons or ravines, and stand as solitary outliers capped by remnants of a hard bed of rock. These remnants are the "buttes" and "temples."

The great height of the plateau gives rapid fall to the streams that enter the canyon, and enables them to cut powerfully and deeply, and thus to carve the rocks into forms that are fashioned on a gigantic scale. The erosion accomplished by these streams is intermittent, because the streams are fed mainly by intermittent rainstorms in an arid climate; but it is none the less effective. The slopes here are partly bare of vegetation, because the desert plants grow far apart. They are therefore unprotected, and the concentrated energy of a single torrential shower may work more havoc than would be caused by a season's rainfall on plant-covered slopes in a humid region. The prevailing dryness, by retarding the growth of vegetation and the formation of soil, keeps sharp and fresh rock profiles that would soon be obscured in a moister region.

In the Grand Canyon to-day we see the accumulated results of the action of powers of erosion during untold ages, and the process is still going on. The various agents that have modelled the canyon—the rushing torrent below and the small streams that descend to join it; the intermittent rain and snow and frost; the

subtle yet effective chemical activities that aid in the decay of the rocks, and the ever-present pull of gravity on all loose particles—all these are still at work on this wonderful piece of earth sculpture.

One of the most striking features of the Grand Canyon is the fact that it is hidden until one actually reaches it ; there is no gradual preparation for the final scene. Approaching by rail or road, the visitor comes upon it quite suddenly. If he pushes through the woods from the motor camp ground, or climbs the stairs from the railway station, it is there at his feet in all its solemn grandeur. The effect on every visitor is to produce a period of awe-struck silence. The rim of the canyon is one of the stillest places on earth, even when it is crowded with people. Many readers will remember the world tour made by Mr. Frank Hornby in 1926, and described in a series of articles in the "*M.M.*" from August, 1927, to May, 1928. It is interesting to recall Mr. Hornby's description of his impressions of the Grand Canyon.



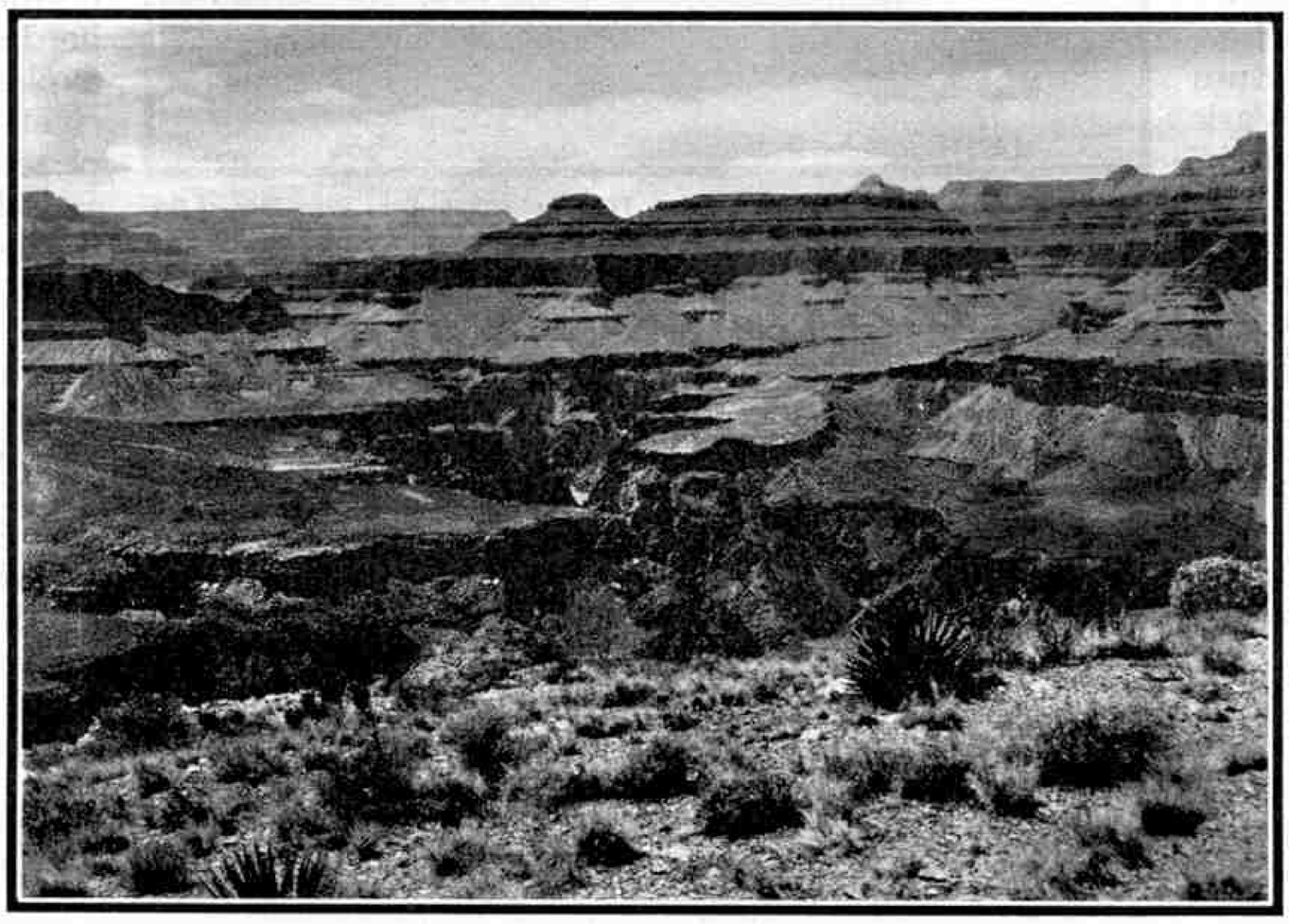
View of the Grand Canyon looking east from Yaki Point, showing Cape Royal, Wotan's Throne, Vishnu Temple, the Palisades of the Desert, and part of the Inner Gorge.

"Whenever I visit for the first time some world-famous place about which I have read innumerable descriptions and which is familiar to me through photographs, I always wonder whether my expectations will be realised, or whether I shall be disappointed. I experienced this feeling as I approached the rim of the Grand Canyon, and then in a flash all the ideas I had formed were swept away in a gasp of astonishment. I never imagined that such a stupendous gash in the earth could possibly exist ! It appears as though mighty hands had literally torn the earth asunder and left a gaping chasm, the scars of which had never healed."

One of the first and most powerful impressions made by the canyon is that of its motionless unreality ; yet it changes with every hour of the day. There is the Grand Canyon of the early morning, when the light slants lengthwise from the Painted Desert. The great capes of the northern rim shoot into the picture, outlined in golden light against which their shapes gloom in hazy blues. Certain temples seem to rise slowly from the depths, or to step forward from hiding places in the opposite walls. Down on the green floor the twisting inner gorge discloses here and there lengths of gleaming water, sunlit and yellow.

An hour later all is wholly changed. The dark capes have retired somewhat and now are brilliant-hued and thoroughly defined. The temples of the dawn have become remodelled, and scores of others have emerged from the purple gloom. The Granite Gorge, now detailed fully, displays waters that are plainly muddy even at this great distance. And now the opposite wall is seen to be convoluted, possessing many headlands and intervening gulfs.

And so, from hour to hour, the spectacle develops. Midday, with sun high behind the south rim, is the time of least charm, for the opposite walls have flattened, and the temples of the depths have lost their defining shadows. But as afternoon progresses the spectacles of the morning creep back, now reversed and strangely altered in outline. It is a new Grand Canyon ; the same, but wonderfully different. Just after sunset the reds deepen to dim purples and the grays and yellows and greens change to magical blues. In the dark of a moonless night the canyon suggests unimaginable mysteries.



View down the Inner Gorge from Mormon Flats.

The rim of the canyon may be explored by motor car, on horseback or on foot ; the descent to the floor and to the river is made on mule-back. There are three practicable trails from the south rim, the one most commonly used being the celebrated Bright Angel Trail, which starts close to the El Tovar Hotel. The descent of this trail is made on mule-back in parties led by guides. It is a sad mistake for persons not in the soundest physical training to attempt it on foot, for the apparent distance as seen from the rim is misleading, and the climb back

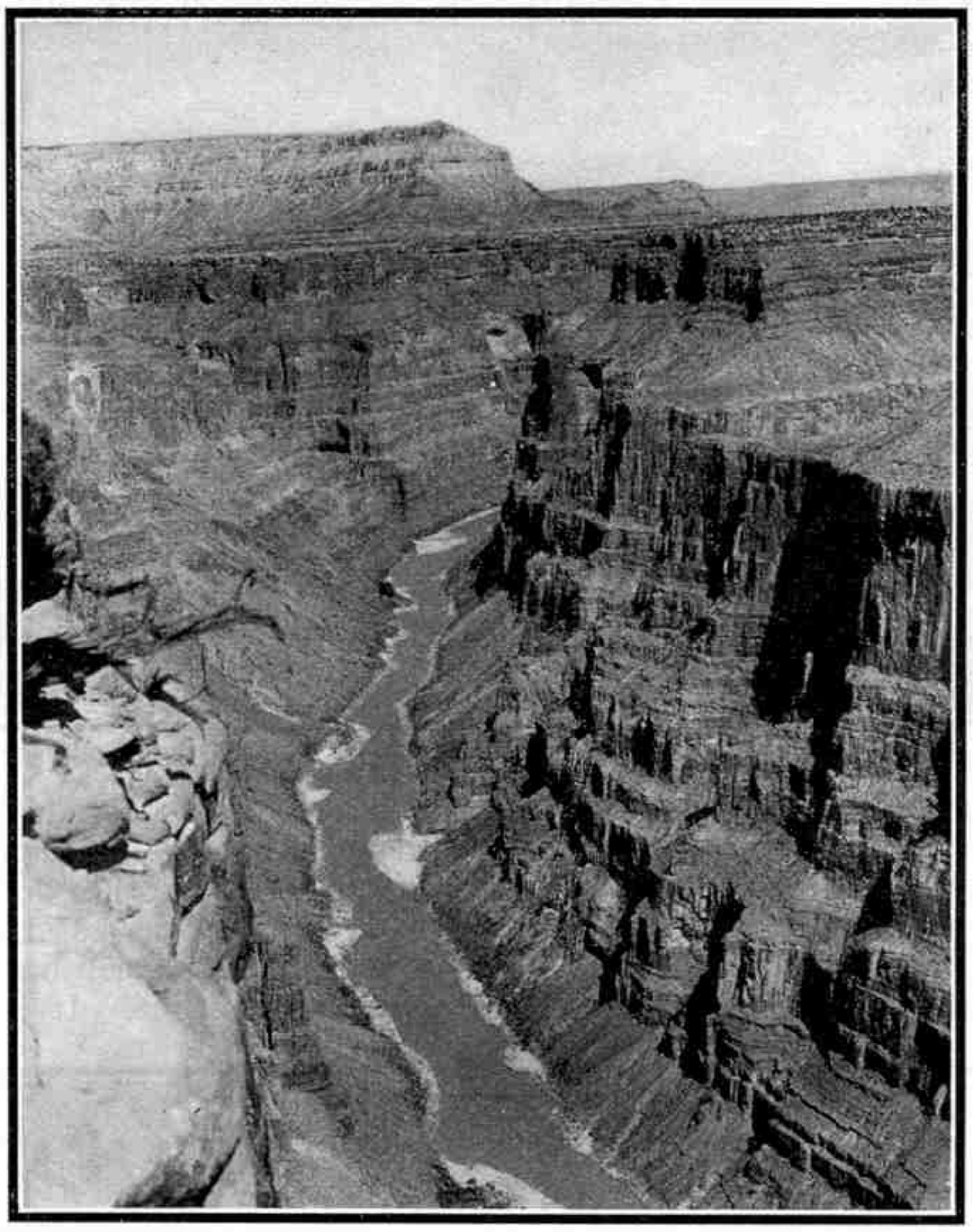
is most arduous at that elevation. The south rim of the canyon at park headquarters is 6,886 feet above sea level. Nearly every day one or more "hikers," overconfident of their endurance, find the way up too arduous, and have to be assisted by guides and mules sent down for them from the rim.

The traveller passes in review during the descent all the strata that form the canyon walls, and a succession of plant growth equivalent to several climatic zones, and representing floral changes such as ordinarily can be seen only by traversing many hundred miles of level country. There are two steep cliffs, descended in series of short zigzags; steep, but always at a safe gradient. It may give the visitor some qualms of nervousness to see his mule hang its head over short abysses at the turns, but the rider himself does not hang over them, and the mule is sure-footed, stolid and indifferent.

Another and finer trail descends the Hermit Canyon. The trip occupies two days, the night being spent at the Hermit Creek Cabins, well down in the canyon. At one point, about 1,000 ft. below the rim, is to be seen in the sandstone an interesting series of tracks of prehistoric animals. Similar tracks are to be seen along the Kaibab Trail, which is even more interesting both from the scenic and the engineering points of view. This trail crosses the Colorado River by means of the Kaibab Suspension Bridge, a thoroughly modern structure built by the National Park Service, and completed in the summer of 1928. The bridge is 440 ft. long, supported from eight $1\frac{1}{2}$ in. steel cables, provided with a structural steel truss acting both as a stiffening member and as guard rails. It is further stiffened by two $1\frac{1}{2}$ in. wind cables, and unlike the old "swinging bridge" that it replaces, the new bridge is free from sway or vibration, even when loaded to capacity with a full string of saddle or pack animals. The south approach to the new bridge is through a tunnel 105 ft. long, cut from the solid granite walls of which the inner gorge is formed.

The construction of the Kaibab Trail through the limestone was both daring and ingenious. Here, with drill and powder, the trail was hewn from the solid rock cliff in half-tunnel sections. At such points, however, the trail is made sufficiently wide, and it is provided with a heavy rock guard wall of such proportions that the traveller has no feeling of insecurity. At one point in a sandstone formation the trail passes through a full tunnel some 38 ft. long. Above this it climbs through oak brush, pine, fir, and finally quaking aspen, to come out on Bright Angel Point at an elevation of 8,350 ft.

At the far western end of the park is the Havasu Canyon. The trail begins at the end of a long semi-desert road by descending precipitously to a gorge through which is reached the Havasupai Indian Reservation, two-fifths of a mile down in the earth. The home of this little band of less than 200 Indians is in a most romantic situation, and the surroundings are beautified by falls of water over precipices several hundred feet in height, backed by grottos of stalactites and stalagmites. This water all comes from springs that gush forth in surprising volume near the Havasupai village. It is interesting to note that the name Havasupai means "people of the blue water." The Indians live by farming, corn being their principal product, but melons, figs and peaches also are produced. The Havasupai women are clever at basket-making, and the baskets made by the older weavers are of very fine mesh, with attractive designs. In their early days the Havasupais undoubtedly were cliff dwellers, and their rude pathways formed the foundation of the present trails.



The Inner Gorge of the Grand Canyon. This photograph gives some idea of the enormous depth to which the Colorado River has cut its bed.

The early Spanish explorers first reported the Colorado River in 1540, and 36 years later a Spanish priest found a crossing at a place that is known to this day as the "Vado de los Padres"—"The Crossing of the Fathers." From that time for nearly a century the canyon seems to have been visited only by wandering Indians, Mormon herdsmen and trappers. The exploration of this great river was ultimately completed by Major J. W. Powell, a one-armed veteran of the American Civil War, who subsequently became Director of the United States Geological Survey.

Major Powell started with nine men and four boats from Green River City in Utah in 1869. He launched his flotilla on 24th May, and on 30th August landed at the mouth of the Virgin River, more than 1,000 miles from his starting point. One of the men left the party early in the trip, and three others deserted later and were killed by Shewits Indians. The journey was one of extreme hardship and danger, and the five who remained faithful to Major Powell must have been men of extraordinary courage and tenacity. Day by day they faced the unknown at every bend of the river, embarking without hesitation upon swift rapids, knowing that these might terminate in dangerous rocks or great falls.

Undeterred by the perils and hardships of this trip, Powell undertook further expeditions during the next three years in order to complete his task. Other daring explorers have since covered the same ground and during the period 1914 to 1924 numerous expeditions up the Colorado River were carried out by the United States Geological Survey.

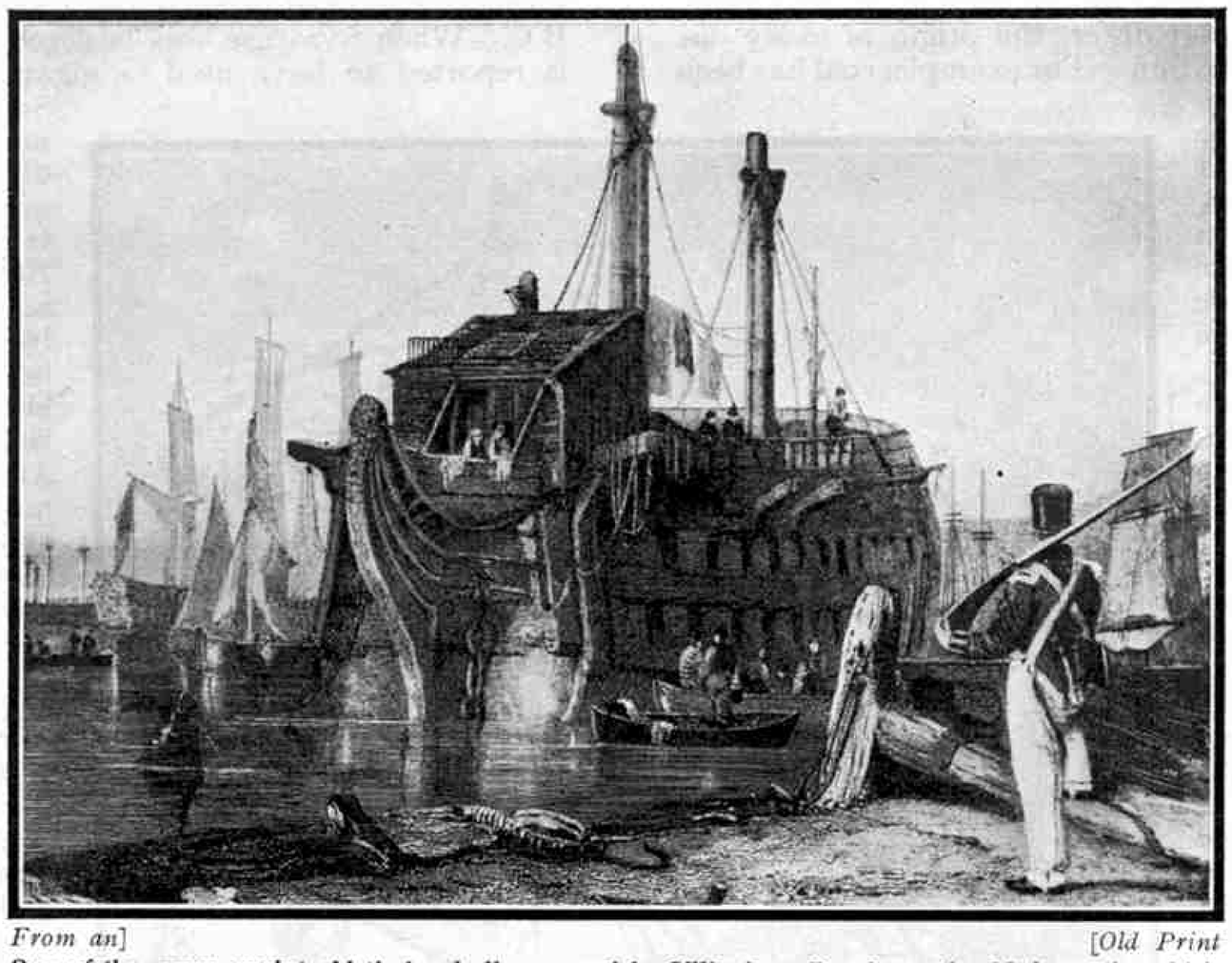
Prisoners in the Napoleonic Wars

Wooden Hulks on the Medway

By W. Coles Finch

MOST readers will know of the method adopted in this country of dealing with the prisoners taken during the Great War. These men were confined in large numbers in great encampments fenced about with barbed wire, and guarded by sentries. It will be interesting to look back to the time of the Napoleonic Wars and see something of the method then adopted to safeguard our prisoners.

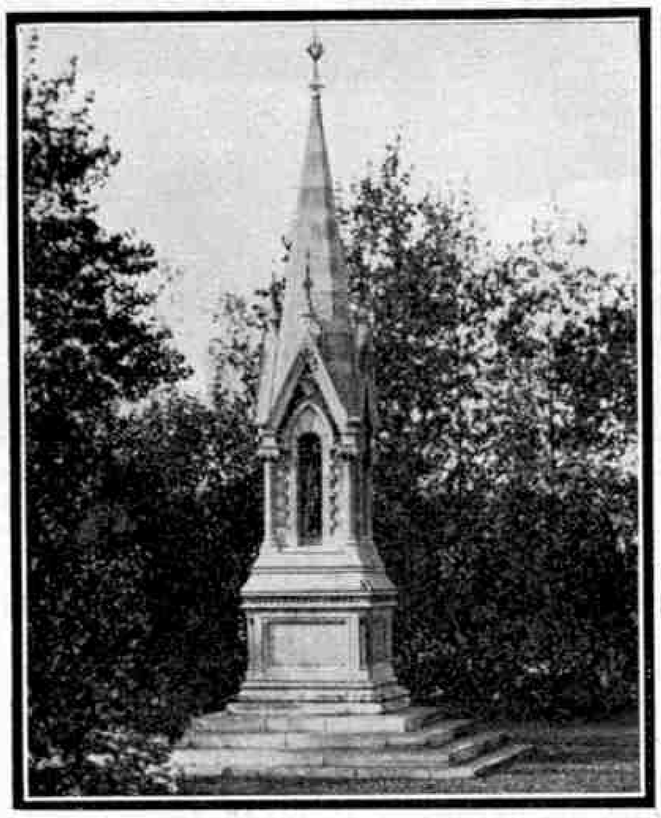
We must picture the River Medway between 1803 and 1814. The soldiers and sailors taken in the great struggle were imprisoned in various parts of the country, those sent to Chatham being confined in large old wooden ships or hulks, which were moored in Gillingham Reach. These old "wooden walls" gave a peculiarly picturesque appearance to the river, and their general style is well shown in the accompanying illustration.



From an] *[Old Print*

One of the many quaint old timber hulks moored in Gillingham Reach, on the Medway, in which were confined prisoners taken during the Napoleonic Wars.

Of the life the prisoners led during their incarceration we know little, but we know that very many died, and were buried at various spots on the marshlands lining the river in the vicinity. In 1855, during the construction of the Dockyard Extension by convict labour, these interments of French prisoners were exposed. With due reverence the skeletons were re-coffined and re-interred. For this purpose the Admiralty formed a cemetery on St. Mary's Island near by, and laid it out with shrubs and flowerbeds. They also erected a fine memorial to the dead. These re-interments took place from about 1860 to 1885, and it is said that many parties of French tourists visited this cemetery, and that both the French and the British Governments contributed towards its upkeep.



Photo] *[W. Coles Finch*

The memorial at the Naval Barracks to French prisoners who died in captivity.

In 1904, as an honour to the vanquished, the bodies were again taken up and transferred to their present resting place at the Naval Barracks, beside St. George's Church. Here a secluded spot is set apart for this purpose, tastefully laid out, and presided over by the fine Gothic memorial from the original cemetery. It is said that this splendid monument is the work of a convict mason. The site of the original cemetery on St. Mary's Island may still be seen.

Some readers may wonder whether any prisoners ever escaped and regained their freedom. The writer can vouch for at least one successful attempt. It was his privilege to know the veteran John I. Hill, the oldest freeman of the river Medway, who had lived under the reigns of five monarchs. Although 94 years of age, he delighted in telling the writer of his own father, who in this connection had an experience worth relating.

On Friday night, October 10th, 1810, three French prisoners of war escaped from one of the prison ships lying in Gillingham Reach. After roughly handling the watchman at Folly Point, and obtaining possession of his small boat, they boarded a fishing vessel belonging to a Strood fisherman named Thomas John Hill who, with his apprentice George Ratcliff, was asleep in the cabin.

Hill made a desperate resistance, his only weapon being a chopper. He probably would have kept the three Frenchmen at bay, but his weapon became useless on account of the handle coming off. He shouted for his apprentice to come on deck to his assistance, but the lad was so alarmed that he would not turn out. The Frenchmen then gained the upper hand, and Hill, after receiving several blows on the head and body, jumped into the river and swam to the marsh.

The Frenchmen set sail, taking the apprentice with them, promising not to hurt him if he would pilot them clear of the sand and mud banks, and answer the sentries as they were challenged when passing the guard-ships. This the lad did, and Hill never saw his boat again. When peace was proclaimed, Ratcliff returned home, but unfortunately he never wrote an account of his adventures.

Putting the Sun to Work

Engines that Make Direct Use of Solar Heat

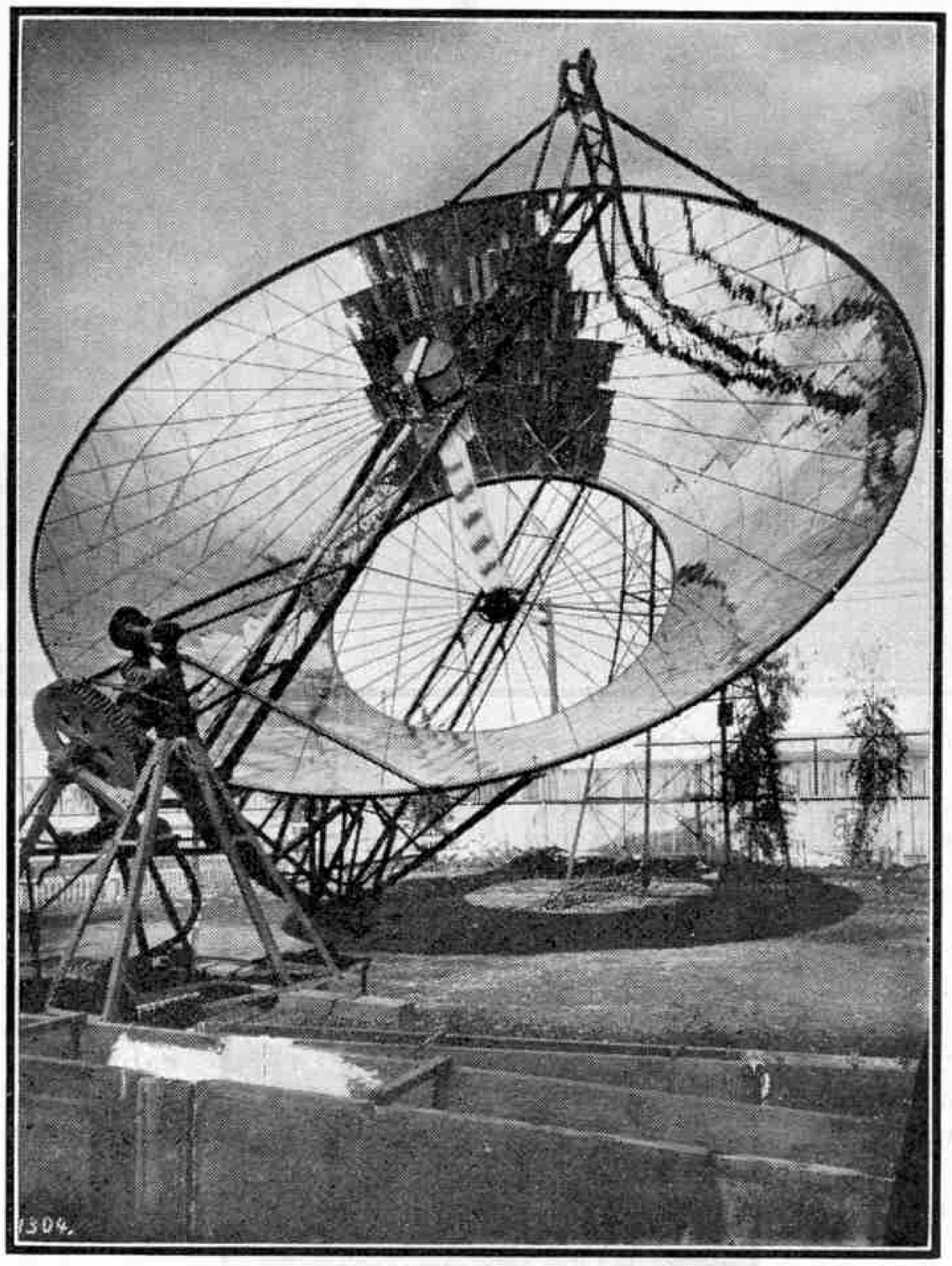
ONE of the chief factors in the growth of civilisation has been the skill that Man has shown in employing first animals, and then inanimate sources of power, to do his work for him. In the early days of settled life he made use of the ox, the camel and the horse as beasts of burden. Later he learned to harness the wind and waterfalls, and the story of power is one of gradual advance from the employment of crude windmills and watermills to the use of steam and electricity generated by burning wood, coal or oil. Widely as these sources of power differ, the origin of every one of them can be traced back to the Sun. For example, coal has been described as "bottled sunshine," for it consists of the carbonised remains of plants that flourished millions of years ago, and made use of sunshine in turning carbon dioxide into the chemicals of which they were composed. Oil also represents the solar energy of past ages, and even the wind and waterfalls owe their origin to the Sun, for movements in the atmosphere and the fall of rain are due to the heating power of its rays.

As all the energy at our disposal is ultimately derived from the Sun, it is not surprising to find that from time to time inventors have turned their attention to schemes for making direct use of the power that streams down on the Earth in the form of sunshine. The time will come when the problem of harnessing the Sun will demand serious attention, for other sources of power will be worked out, or will prove insufficient to meet requirements. There is no doubt that Man cannot continue to use coal and oil indefinitely, for it seems almost certain that these substances are no longer being produced in any quantity in the Earth, and our supplies ultimately must become exhausted.

So far as we can see, the winds will continue to blow for millions of years, but the amount of power they give is very small. Running water is more promising, for so long as the Earth retains moisture its streams may be harnessed; but there is a limit to the amount of power we can obtain in this manner, for most of the water that falls as rain makes its way back to the sea in comparatively sluggish rivers that are of little use for power production. The tides do not seem likely to form sources of power on a large scale, for except in certain favoured bays and narrow seas the changes in the level of the ocean are too small to be utilised economically. It seems very probable, therefore, that when coal and oil are exhausted, other existing sources of power will prove inadequate, and Man will be compelled to rely upon his ability to harness the Sun.

The quantity of solar energy available is amazing, for it has been calculated that the Sun radiates 12,500 h.p. from every square foot of a surface that measures billions of square miles. This energy streams out in all directions, but the proportion of it that reaches the Earth is sufficient to develop 7,300 h.p. on every acre of its surface. This energy is not all actually available, however, for the Sun only shines on a part of the Earth's surface at one time, and moisture and dust cut off a surprisingly large proportion of sunshine. Even on a clear day in a tropical country only 70 per cent. of the Sun's rays that reach the neighbourhood of the Earth succeed in penetrating its atmosphere; yet even in these circumstances bright sunshine falling on 2½ acres of ground yields as much energy as can be obtained by burning one ton of coal.

The story of efforts to harness the Sun may be said to begin with the legend of the burning mirror of Archimedes, the famous Greek scientist who lived in Syracuse, a Sicilian city, in the third century B.C. When Syracuse was besieged by the Romans, Archimedes is reported to have used a gigantic mirror to concentrate the Sun's rays on the enemy's ships in order to set them on fire. It is difficult to believe that he really accomplished this, but it is interesting to learn that in 1747 Buffon, the French naturalist, set fire to a plank of tarred wood by directing upon it sunlight reflected from several flat mirrors. He did this in order to show that the idea behind the alleged feat of Archimedes was correct. Lenses may be used instead of mirrors in experiments of this kind, and there is no difficulty in setting fire to a piece of paper, or some equally combustible material, by the Sun's rays concentrated by means of a convex lens.



Solar motor erected at Pasadena, California. The reflector contains 2,000 mirrors, which concentrate the Sun's rays on the boiler at its focus, and the steam produced works an engine that pumps about 100 gallons of water a minute.

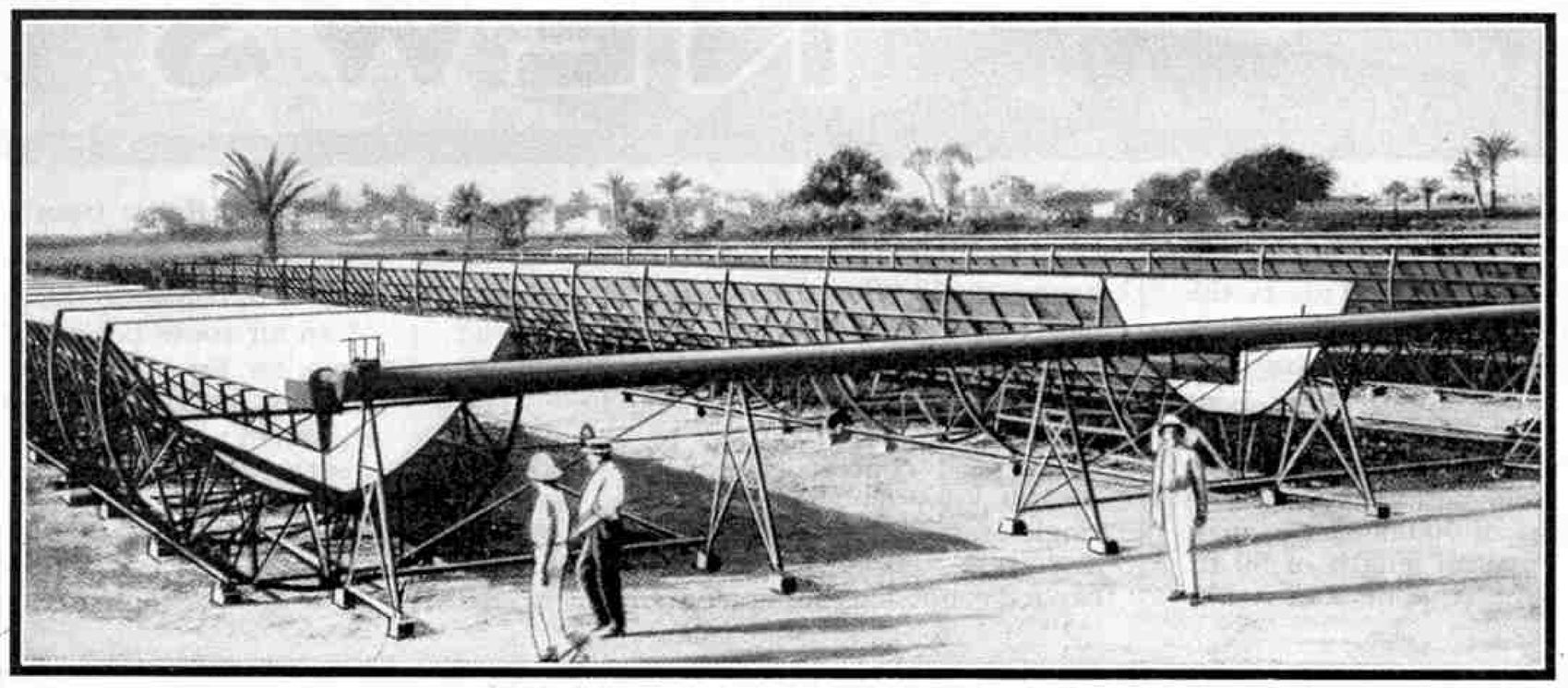
What may be described as the first serious effort to make use of the energy of the Sun was not made until more than a century after Buffon's experiment. Then a Frenchman named Mouchot arranged mirrors round a framework resembling that of an umbrella opened out to half the usual extent. This device was exposed to the Sun in such a manner that the mirrors reflected the rays to a boiler placed in the centre. The boiler used in this "solar engine," as Mouchot called it, held 3½ lb. of water, and this was brought to boiling point in one hour. A larger model built in 1872 was automatically turned to follow the Sun from east to west in order to take the fullest possible advantage of its rays.

No practical results followed the invention of Mouchot's solar engine, nor were the experiments of John Ericsson more successful. Ericsson helped to design the "*Novelty*," one of the rivals of the "*Rocket*" at the Rainhill trials held in 1830 to determine the form of locomotive to be used on the Liverpool-Manchester Railway; and in 1862 he built the "*Monitor*," the first battleship with a revolving gun turret. He is said to have spent £20,000 on trials of various forms of sun motors, only to come to the conclusion that the apparatus was far too costly to compete with ordinary boilers fired by coal.

In spite of Ericsson's adverse opinion, inventors continued to devise schemes for making use of the free source of power showered down upon us by the Sun. Practically all of them built reflectors similar in shape to that of Mouchot, and in 1878 a Frenchman named Piefre actually succeeded in driving a small printing press by means of steam raised in the boiler of a solar engine nearly 12 ft. in diameter. About the same time an Englishman named Adams, who lived in India, invented a solar cooker with which he produced excellent stews and roasts. His cooker took the form of a box with eight sides on which mirrors were fixed. The sides sloped outward,

and the rays of the Sun beating down on the box were reflected on to the sides of a miniature oven in the centre. The cooker was very successful in India, where the Sun's rays are very powerful, but it would be of little use in a country like Great Britain.

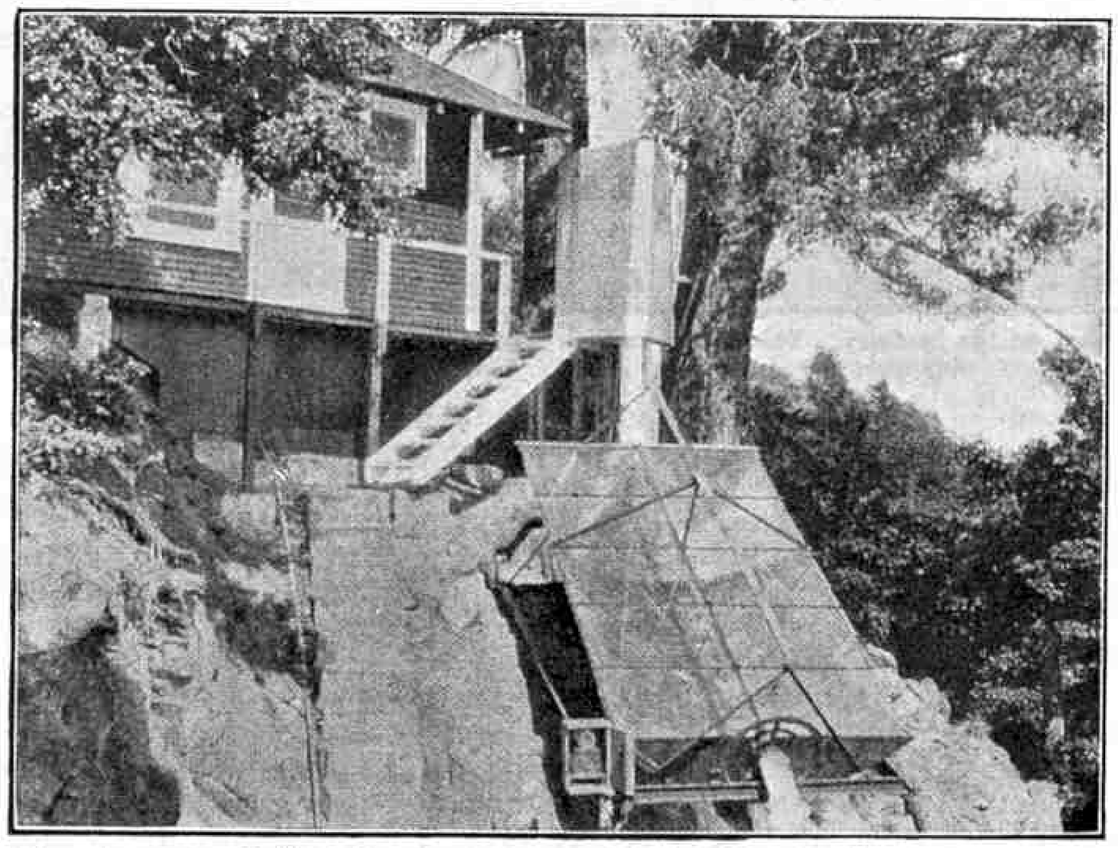
About the beginning of the present century more serious efforts were made to solve the problem of harnessing the Sun. American inventors were chiefly responsible for these, and some very promising solar motors were built in California by an engineer named Eneas. He built a reflector of the usual form, and equipped it with automatic machinery that turned it to face the Sun at all hours of the day. Two concentric steel tubes served as a boiler, the water circulating up the space between the two, and then down the inner tube to complete the circuit.



The Shuman-Boys solar heater at Meadi, near Cairo, Egypt. On the left, the long thin boiler in one of the five channel-shaped reflectors is clearly visible. These reflectors collected sunshine over a total area of 13,269 sq. ft.

Eneas built other sun motors, and it is believed that he constructed the one at Pasadena, shown on the previous page. From a distance this looks like a huge open umbrella, inverted, and with a piece cut off its top. It is balanced on a high steel framework, and is set at such an angle that it will catch the sunbeams on its 2,000 mirrors. Each of these mirrors is 2 ft. in length and 3 in. in width, and reflects the sunshine on to a long cylinder, corresponding to the handle of the umbrella, which holds 100 gallons of water. The boiler is of steel, covered with a heat-absorbing material, and steam at a pressure of 150 lb. per sq. in. can be raised in one hour. When the machine is made ready for work—a task for a boy who has merely to turn a crank until an indicator shows when the Sun is truly focussed on the mirrors—it moves round automatically so that its face is kept turned to the Sun all day long. The steam works an engine that is capable of pumping about 100 gallons of water a minute.

While Eneas was developing his sun engine in California, another American inventor, named Shuman, built one of a different but equally interesting type. It is well known that the Sun's rays lose no heat while travelling through space, but only deliver up their energy when they fall on something material. Black bodies absorb heat best, white or brightly coloured objects taking it up inefficiently and much more slowly. Shuman therefore used blackened pipes to absorb the heat of the Sun, and sank these in cold water contained in a horizontal box with a closed top. The pipes contained ether, which boils at the low temperature of 35 deg. C., and the vapour given off by this liquid when it boiled was used to drive a small single-cylinder engine.



The solar cooker built at the observatory on Mount Wilson, California, by Dr. C. G. Abbott. The reflector is used to heat oil that circulates round the oven placed above it.

Shuman built several solar engines of this kind, one of which developed 3½ h.p.; and eventually a company was formed for the purpose of developing his ideas. In collaboration with Professor C. Boys, a prominent English scientist, he designed a larger plant that was erected at Meadi, a village on the Nile, about seven miles south of Cairo. Interesting changes were made, Professor Boys suggesting that the absorber should be replaced by a channel-shaped reflector of parabolic cross section. A deep but narrow metal box was used as the boiler, and this was placed in the box of the reflector in order that the Sun's rays could be concentrated on both sides.

The plant erected at Meadi consisted of five of these trough-shaped reflectors, each being 205 ft. in length. They ran north and south, and were tilted by automatic gearing in order to enable them to make full use of the Sun's rays throughout the day. Sunshine collected from a total area of 13,269 sq. ft. was reflected to the long boilers, and in the most successful trials 1,442 lb. of steam was produced in an hour. The maximum output of the plant was about 55 h.p., which was 10 times greater than that produced in any previous solar heater.

The Shuman-Boys experiments have not yet been followed up, for the plant was more costly to erect and run than a boiler fired by means of coal. The effort was very promising, however, and shows that when the need arises there will be little difficulty in making direct use of the heat of the Sun. It has been suggested that a solar heater of the Shuman-Boys type could be employed profitably in irrigation work in tropical countries, for it could be used to operate the low power pumps by means of which the water of irrigation canals is distributed. These pumps would not work efficiently in dull weather, but they would not be needed at such times, for cloudy skies bring rain. Prolonged periods of drought would be accompanied by bursts of brilliant sunshine, and pumping operations then would compensate for lack of rain.

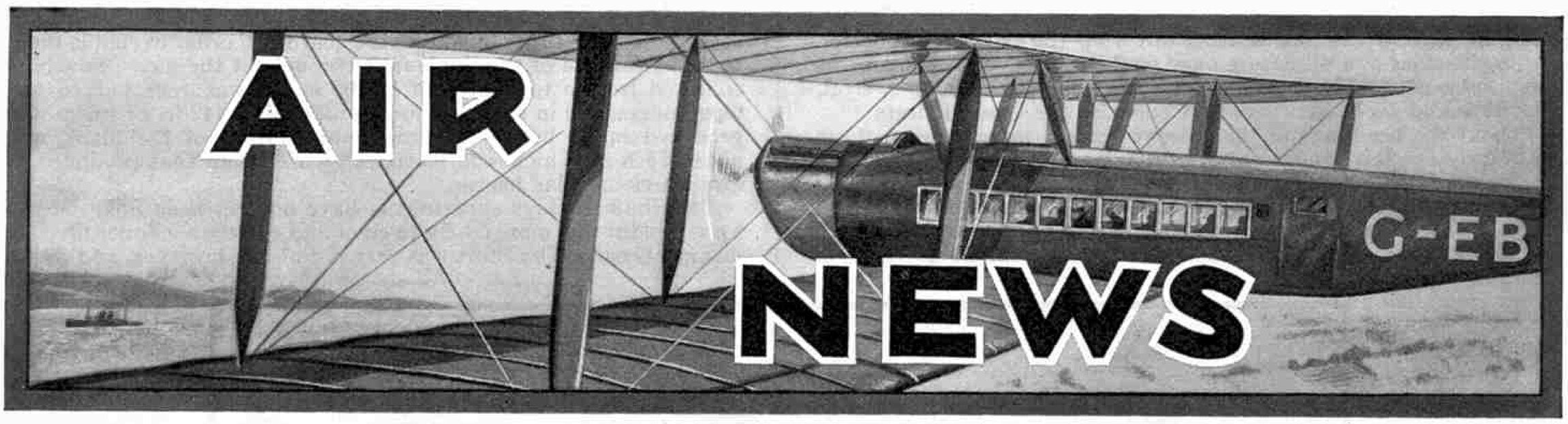
Another interesting proposal for making use of solar heat has been made by M. Claude, a French scientist, who has constructed a turbine to work with steam at very low pressure. The steam that he proposes to employ is merely the vapour given off from the surface water of the sea, while at the other side of the blades of the turbine will be a vacuum, which is to be maintained by cold water pumped up from a greater depth.

The conditions required for this solar engine are met with in tropical seas. There the temperature of the surface water is from 20°C. to 25°C. higher than that of the cold water brought in at great depths by polar currents. M. Claude has chosen the West Indies for a trial of his scheme, and at a point off the northern coast of Cuba he has sunk a long tube to the bottom of the sea. The cold water required will be pumped up through this tube, and when the plant is in working order the energy needed for this purpose will be supplied by the turbine itself. If a reasonable amount of surplus energy is available, the scheme will provide a splendid means of utilising power that may be tapped as long as the Sun and the sea exist, for it is solar heat that stirs up the oceans and causes the flow of currents in them.

Although efforts to make direct use of the power of the Sun have not yet been commercially successful, many interesting plans have been devised for employing it on a small scale. For instance, a settler in Chile distilled water in a plant in which the boiler was heated by means of the Sun's rays; while in the United States Dr. C. G. Abbott, a famous American astronomer, built a novel Sun-heated oven in which meat and vegetables could be cooked in a satisfactory manner. This was installed at his home at the Observatory on Mount Wilson, California, the mountain on which the 100-in. reflector, the world's largest telescope, has been erected.

In Dr. Abbott's device the heat of the Sun was used to raise the temperature of oil circulating round the oven, which was built separately from the heater. This consisted of sheets of polished aluminium bent to form a trough of

(*Continued on page 726*)

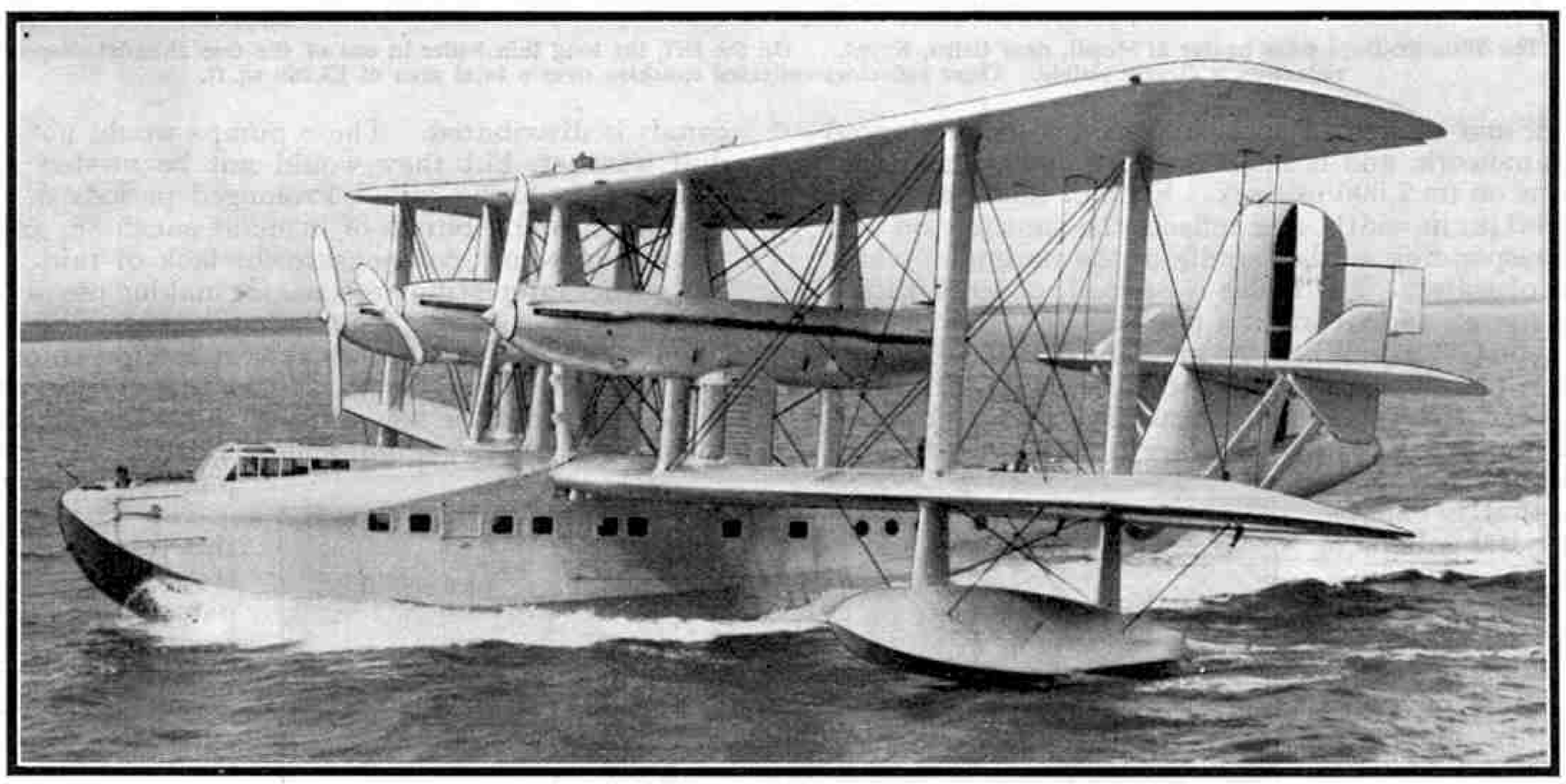


Largest British Flying Boat

The illustration on this page shows the largest British flying boat. This is the product of Short Bros. (Rochester & Bedford) Ltd., and is second in size only to the "*DO.X*," the German flying boat described in the "*M.M.*" for December 1929, which is the largest vessel of this kind in the world. The new Short machine has an all-up weight of 70,000 lb., a span of 120 ft., and an overall length of 89 ft. 6 in. Its height is 30 ft. 4 in. and it has accommodation for about 10 people. Six Rolls - Royce "Buzzard" engines, each developing 820 h.p., are employed and these are mounted in tandem in pairs, a practice that is followed with the four engines installed on the Short "Singapore" Mark II.

The machine has been built for the Air Ministry and is to be used by the R.A.F. for long-distance bombing and reconnaissance work. It is of metal construction except for the wing coverings, which are of fabric; and the bottom of the hull is planked with stainless steel and has two steps. The engine nacelles are supported by streamlined turrets. These turrets are hollow in order to give access to the engines for adjustment and repairs during flight, and they are provided with doors to enable mechanics to get out on to the wing.

Full details of the new flying boat are not yet available, but we hope to include a full description in an early issue of the "*M.M.*"



The new Short flying boat on the Medway. This is the largest British machine of its kind and is described on this page. Our photograph was taken by Mr. W. H. Evernden of Faversham.

The Miles "Satyr"

An interesting little single-seater light biplane has been built recently by George Parnall & Co. Ltd., to the design of Mr. F. G. Miles. The machine is named the Miles "Satyr" and is particularly suitable for private owners who want a fast machine that is not expensive in operation. The "Satyr" should also be easy to "garage" for it is only 18 ft. in length and the span of the upper wings is 21 ft.

An International Air Speed Trophy

A new international air trophy, to be known as the "*Coupe Deutsch de la Meurthe*," has been created by the Aero Club de France, in memory of its late President, M. Henry Deutsch de la Meurthe. The trophy is to be awarded to the winner of a speed contest over a closed circuit of 100 km., or about 62 miles, open to single-seater heavier-than-air craft of any type, equipped with engines of a capacity not exceeding eight litres. All machines entered for the event must be proved capable of covering the course at a speed of at least 200 km.h. or 124 m.p.h.

The trophy will be held for a year by the country or club nominating the winning pilot, who will receive a cash prize of 100,000 francs. It will become the property of any country winning it three times, not necessarily consecutively, and races must be held at least once every two years. The first contest probably will take place in the summer of 1933.

New Training Machine for R.A.F.

Avro "Tutor" machines have been officially accepted as the new standard training machine for the R.A.F. This type was previously designated the Avro 621 and as such was described on page 865 of our issue for November 1931. It is a development of the Avro 504 and will replace this machine, which has been the standard R.A.F. training aeroplane since 1917 and on which more pilots have been trained than on any other type in the world. The 504 was in its time a development of the famous Avro biplane, which was first produced in 1913.

Arctic Air Route from Europe to America

The four members of an expedition that is to continue the preliminary surveys of an air route between Europe and North America by way of Greenland, Iceland and the Faroe Islands have departed for the north to spend about a year in recording weather conditions and in general exploration of certain areas in Greenland. They intend afterwards to cross the Greenland ice cap, and to return to Europe from the settlements on the west coast of the country.

This survey was begun by the British Arctic Air Route Expedition that returned to England last autumn after spending two years in the Arctic, and the explorers who have undertaken further work took part in the first expedition. Their efforts are supported by the Royal Geographical Society and the British Air Ministry, and also by American airway companies interested in the Greenland route.

Fast Aircraft for American Service

Three Consolidated "Fleetster" aeroplanes are to be used by the Ludington Line on their passenger and express service between New York and Washington. The new machines will enable a cruising speed of 155 m.p.h. to be maintained and occasionally a maximum speed of 180 m.p.h. will be reached.

The "Fleetster" is a nine-seater high-wing monoplane, provided with a Wright "Cyclone" engine equipped with a N.A.C.A. cowling, and it is claimed that its landing speed is only 50-55 m.p.h. Earlier models were fitted with the Pratt & Whitney "Hornet" engine. These had a practically identical performance, but could seat only five or six passengers.

An unusual feature is that the machine is provided with rubber strips along the leading edges of the wing and the rear stabiliser. These serve as protection when the machine flies through heavy rain at high speeds, and prevent the finish of the wing from being spoiled.

The Potez 38

One of the most interesting French commercial machines of recent date is the Potez 38, illustrated below. This is a single-engined high wing monoplane capable of carrying eight passengers. The machine is not of the cantilever type, for its wings are braced and are constructed of wood covered with fabric. The fuselage, which is rectangular in section, is largely of metal. The forward section, in which the cabin is placed employs both metal and wood, but the rear section consists of a metal girder built up of a number of duralumin tubes, covered with fabric. The tail unit is of the normal monoplane type. The undercarriage fitted to the machine is of the divided type. It has telescopic legs to enable it to be used safely on rough aerodromes, and wheelbrakes are provided.

The Potez 38 has a wing span of about 65 ft. 8 in. and is 48 ft. 7 in. in length and 12 ft. 6 in. in height. The chord of the wing is 11 ft. 6 in. The machine weighs 5,412 lb. when empty and is capable of carrying a useful load of 2,420 lb., the loaded weight being 9,370 lb.

It is usually provided with a Hispano-Suiza engine developing 600 h.p., which gives it a maximum speed of 140 m.p.h. The climb to a height of 3,280 ft. occupies 4 min. 20 sec., and 18 min. are required to attain an altitude of 9,840 ft. The absolute ceiling of the machine is 18,000 ft.

A Record Atlantic Crossing

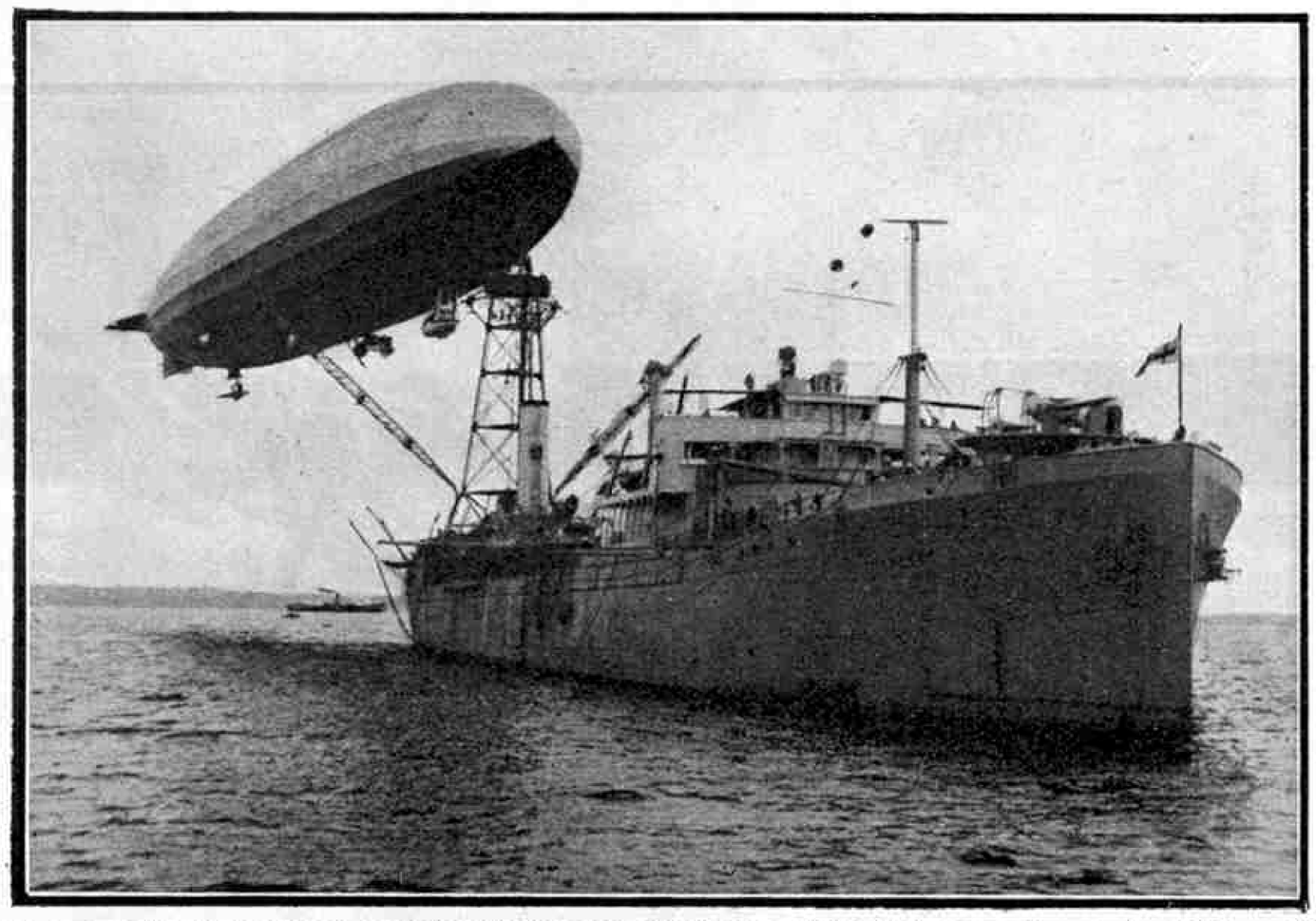
Two American airmen, Major Bennett Griffin of Oklahoma and Lt. James Mattern of Fort Worth, Texas, recently set up a record by making the fastest crossing of the North Atlantic Ocean, the flight from Harbour Grace to the Irish Coast being completed in 11½ hours, or about two hours less than the time taken by Miss Amelia Earheart, the previous record holder. The airmen did not land in Ireland, but flew onward to reach Berlin in 18 hours 42 min., their flight being the first made non-stop from the American continent to Berlin.

The machine employed was a Lockheed "Vega" named the *"Century of Progress,"* and the flight was the second stage of an attempt to create a new record for a journey round the world. Unfortunately the airmen crashed while flying from Berlin to Moscow and were unable to continue their flight. The present record for a journey round the world is held by two American pilots, Wiley Post and Harold Gatty, who made the flight in a Lockheed "Vega" in 8 days, 15 hours, 51 min., and covered about 16,150 miles during the flight.

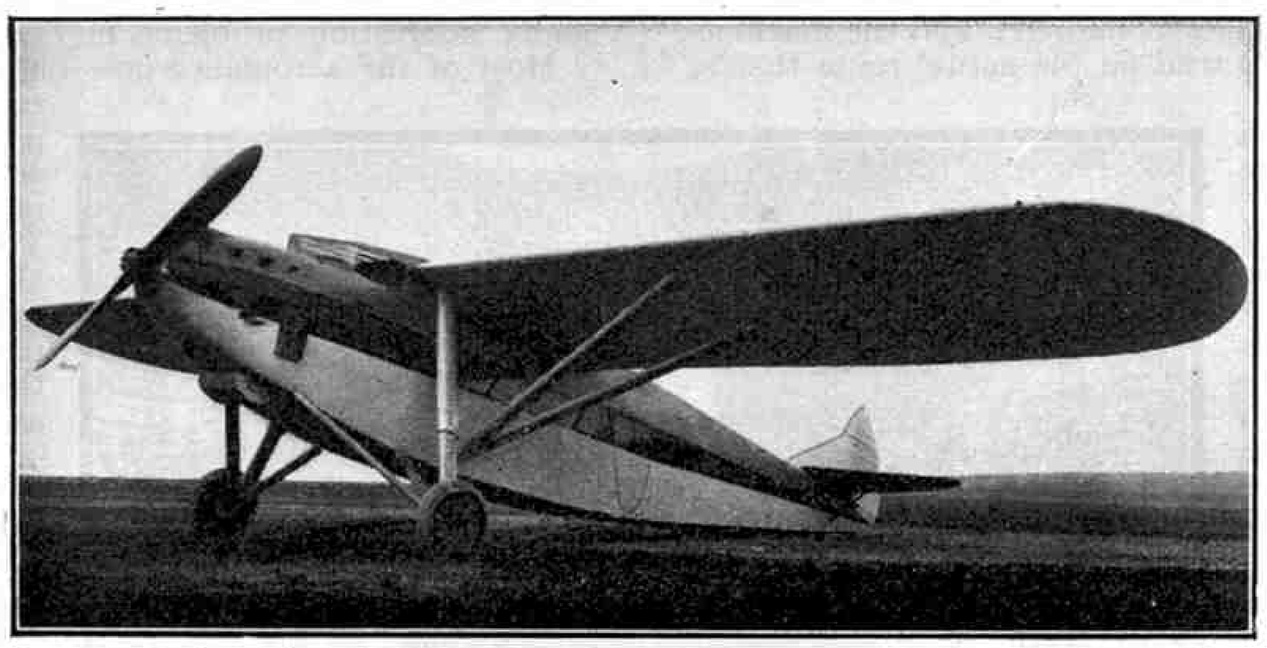
High-Speed Monoplane for American Pilot

A new all-metal monoplane specially designed for fast long-distance flights is now being constructed for Captain Frank Hawks, the famous American pilot who last year set up a number of speed records in long-distance flights in England and on the Continent. The machine will have a span of 48 ft. and will be 29 ft. 4½ in. in length. Its empty weight will be 3,150 lb. and the all-up weight 7,000 lb.

A new type of power unit, the Wright GR-1510 geared two-bank radial 14-cylinder engine, is to be fitted to the machine in order to give it a cruising speed of more than 200 m.p.h. Fuel tanks capable of carrying about 600 gallons of petrol will be provided and the range at a speed of about 200 m.p.h. will be 2,500 miles.



Many experiments have been carried out in the United States in order to find means of employing "blimps," or small non-rigid airships, on air mail services, and our photograph shows a vessel of this type moored to a special mast erected on a sea-going vessel.



Three-quarter front view of the Potez 38, high-wing monoplane with accommodation for eight passengers. It is equipped with a 600 h.p. Hispano-Suiza engine.

25,000-ft. Parachute Descent

What is claimed to be a record parachute descent has been made in France by a well-known airman, Rene Machenaud, who jumped from an aeroplane at an altitude of 24,600 ft. After leaving his machine, M. Machenaud took 23 minutes to reach the ground and during the time he was falling he was blown by the wind a distance of more than 12 miles.

A New "Hermes" Aero Engine

A new edition has been produced of the "Cirrus Hermes," the aero engine described on page 34 of the *"M.M."* for January 1931. The new engine is known as the "Hermes IV," and is of inverted form with four cylinders in line. It combines all the good features of the "Cirrus" and "Hermes" engines, and in its construction advantage has been taken of experience gained with these types. It allows an excellent forward view from the cockpit of a machine to which it is fitted, and its inverted form enables a higher propeller thrust line to be obtained and gives greater accessibility for examination and maintenance. An entirely new feature of the engine is that totally enclosed valve gear is provided, while the cylinder heads are of new and improved design, being detachable and made of aluminium.

The cylinders of the "Hermes IV" have a bore and stroke of 4.7 in. and 5.5 in. respectively, the total capacity being 6,330 c.c. Normally the engine develops 120 b.h.p. at 2,000 r.p.m., and the maximum power is 130 b.h.p. at 2,200 r.p.m. The petrol consumption is low, being 7.8 gallons per hour when the engine is being run at nine-tenths full throttle, and oil is used at the rate of a pint an hour. The engine weighs 300 lb., and is 3 ft. 6 in. in overall length and 2 ft. 5 in. in overall width.

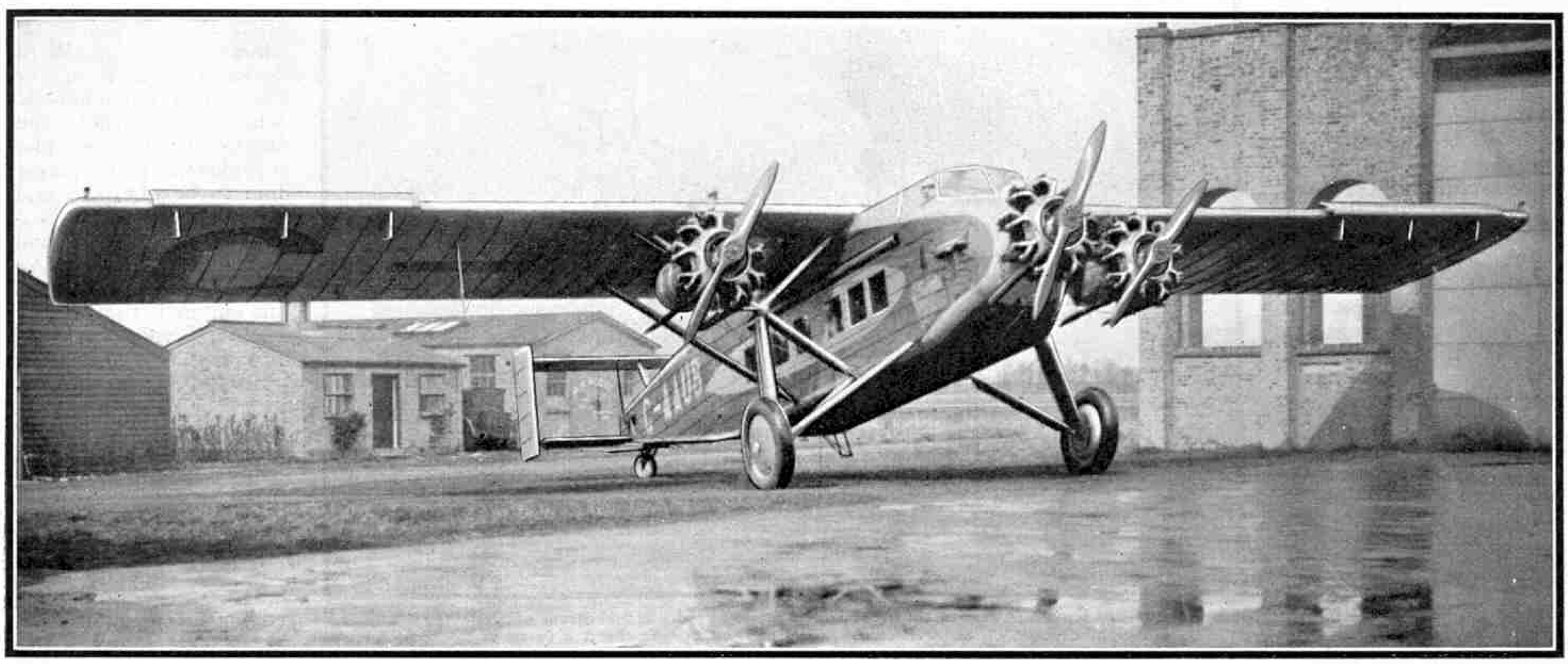
Catapult Mail Service on German Liners

The German liner *"Europa"* now carries a Junker W.34 seaplane, fitted with a Pratt and Whitney "Hornet" engine, for use on the catapult mail service from ship to shore. This seaplane has a maximum speed of about 123.5 m.p.h. and is catapulted from the *"Europa"* when the vessel is about 600 miles from shore. Mails from America are usually carried by air from the vessel to Southampton and then on to Croydon to be taken to Cologne, Hanover and Berlin by means of normal air mail services, thus saving about 48 hrs. in the time of transit between America and Berlin. The saving on the outward journey is between 24 hrs. and 36 hrs.

The *"Bremen,"* sister ship to the *"Europa,"* is also provided with a seaplane and a catapulting apparatus. The seaplane used is a Heinkel H.E.58, and a photograph of it on the catapult was published in our issue for March 1930. It has a maximum speed of about 127 m.p.h. and is equipped with a 500 h.p. Pratt & Whitney "Hornet" engine. The machine was specially designed for this type of work.

The Vickers "Viastra"

Flying Across an Australian Desert



IN 1930 Vickers (Aviation) Ltd. received an order from Western Australian Airways Ltd. for an aeroplane of a new type for service on the Perth-Adelaide air route. The machine was to be flown across the great desert separating Western Australia from the more populous eastern States, and was required to have a sufficient reserve of power to make forced landings extremely unlikely. In order to reduce further the risk of being compelled to land, an unrestricted field of vision from the pilot's cockpit was demanded, and a cruising speed of 140 m.p.h. was called for by the operating company. These requirements were complied with in the Vickers "Viastra," a high-wing monoplane that may be fitted with one, two or three engines as desired; and the machine was so successful in a prolonged trial on the actual route that a second was ordered.

The two machines in service on the Western Australian air route are arranged to fly in "shifts," the average weekly flying time being about 26 hours, and the distance covered approximately 3,000 miles. One aeroplane normally carries on the service by itself for a period, and is then laid up for overhaul while the second machine takes up the running. The cruising speed employed is 115 m.p.h., and this is maintained with engines well throttled down, giving a fuel consumption of about 45 gallons per hour for the two engines installed. The entire trip between Perth and Adelaide has been completed at an average speed of 140 m.p.h. in favourable conditions, while occasionally a speed of more than 150 m.p.h. has been reached over certain sections of the route.

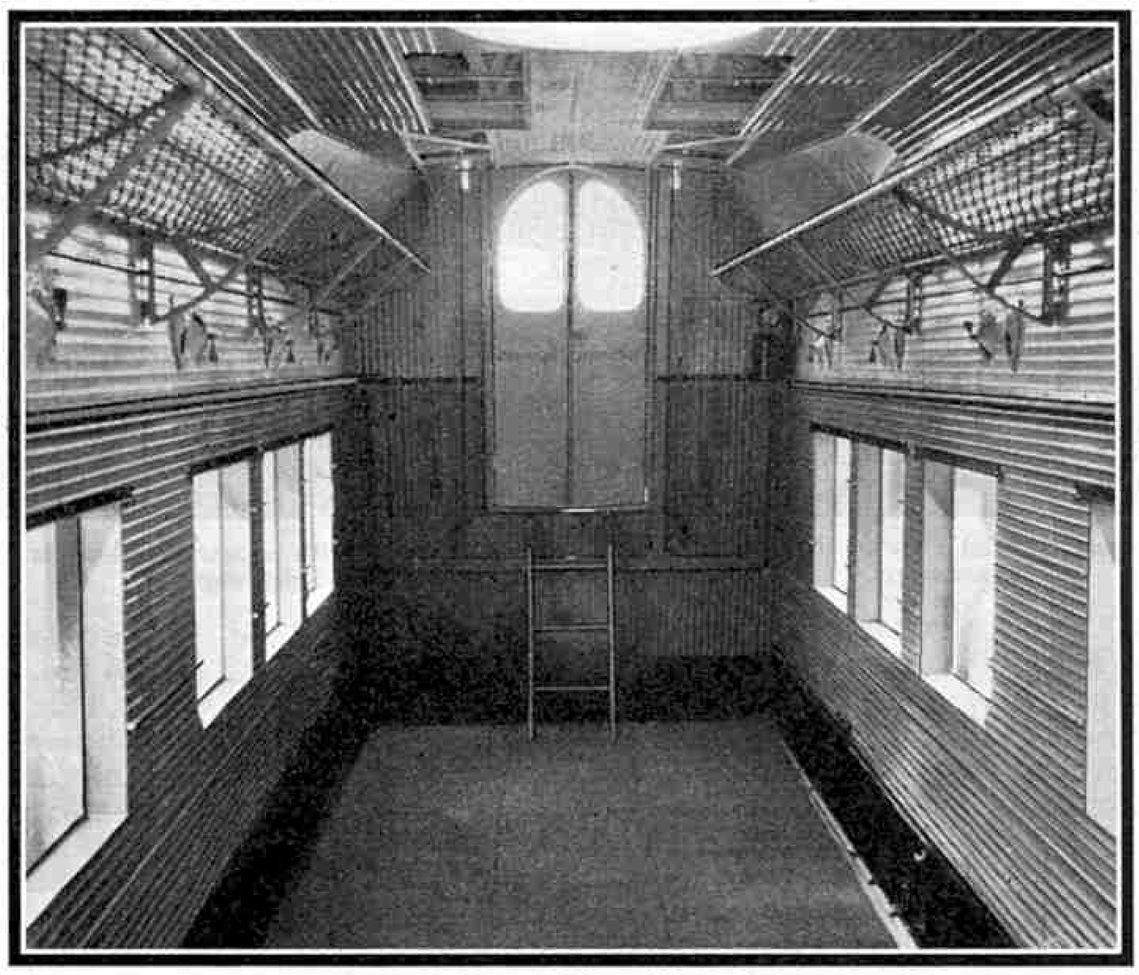
A short time ago a "Viastra" carrying 13 passengers flew from Perth to Adelaide, a distance of about 1,450 miles, in 10 hours. This time was 1 hr. 15 min. less than the previous best, and is believed to be a record for a long-distance flight by a commercial machine carrying a load of this magnitude.

The "Viastra" was introduced primarily for employment on passenger services. It may easily be adapted for use as a freight carrier, however, and in designing it special attention was paid to making it satisfactory for use for a variety of purposes. It was with this aim in view that the aeroplane was so constructed that one, two or three engines of varying types may be fitted, according to the requirements of the purchaser; while it is available either as a landplane or as a twin-float seaplane. Experience with the machine in its alternative forms therefore should help to solve many interesting problems in design and construction.

Most of the aeroplanes now built by Vickers are of all-metal construction. The "Viastra" is no exception, being built wholly of metal, even to the coverings of the wing and the fuselage. The well-known light aluminium alloy duralumin is employed extensively in its construction, particularly for such parts as the struts, and the angle sections and longerons in the fuselage.

The wing span of the machine is 70 ft. and its height is 13 ft. Its length is 48 ft. 6 in. except when two engines are fitted, when there is a reduction of 3 ft. The fuselage is a rectangular structure made in two sections each covered with corrugated duralumin. Packing of a sound-deadening nature has been introduced in the front section where the pilots and passengers are accommodated, but is not necessary in the rear section; and "drumming" due to the vibration of the metal panels has been prevented by placing tiny sand bags in their centres.

The front section of the fuselage accommodates the pilot's cockpit, immediately below which there is a luggage hold of 100 c. ft.



The upper illustration shows the Vickers "Viastra" fitted with three Bristol "Jupiter" engines. Below is the passenger saloon of the "Viastra" with seats removed to show all-metal construction. We are indebted to Vickers (Aviation) Ltd., for the illustrations to this article.

capacity. The cabin is 20 ft. 3 in. in length, 5 ft. in width and 6 ft. 1 in. in height, and accommodates 12 passengers. The cockpit is provided with dual sets of controls, and from it access to the cabin is provided by a small door. Passengers enter the machine through a door on the left-hand side, and their seats are arranged in two rows of six, one row along each side, an arrangement that gives excellent views through the large windows provided along each wall. In order to shut out as much noise as possible the windows cannot be opened except in emergency. A very efficient system of ventilation has been devised, however, and during cold weather the cabin may be heated either electrically or from the exhaust. When the machine is to be employed for freight-carrying purposes the seats in the cabin may be removed quickly and easily, leaving a large space available for goods.

The single-engined version of the "Viastra" in flight over Brooklands Aerodrome. The machine illustrated is equipped with a Bristol "Jupiter X.F. BM" engine, but a wide choice of engines is available.

The rear section carries another luggage compartment with a capacity of 100 c. ft. This is provided with a false floor that is stoutly constructed to support heavy weights, and may be raised if necessary.

The wing is built round two spars provided with flanges of duralumin on which are riveted "wandering webs," or strips of duralumin that zig-zag from front to rear of the spars. The centre section of the wing is built integral with the fuselage and is braced by steel tube struts from it, the front struts assisting to bear the weight of the engines. The wings are fitted with ailerons of the Bristol-Frise type, and the first "Viastra" constructed was provided also with Handley Page slots.

The fuel tanks are inside the wing. They are unusual in design, for they are built up of identical halves secured by means of bolts passing through flanges, packing being used to make the joints petrol-tight. The oil tanks are constructed in a similar manner, and it is claimed that the "Viastra" is the first aeroplane to be fitted with tanks of this design.

Three-quarter front view of the twin-engined Vickers "Viastra," showing the door open. The unusual rudders, described in the article, should be noted.

Another unusual feature of this machine is the tail unit. This is of the biplane type, and is provided with two rudders pivoted round vertical tubes. Thus the whole of the rudder moves when the rudder bar is operated, whereas on most aeroplanes only the rear portion of it turns.

The undercarriage is of a very wide type in order to give great stability when taxi-ing over uneven surfaces. It is not provided with an axle, and therefore is less likely to be damaged by obstructions in the path of the machine. Vickers oleo-pneumatic telescopic legs and Dunlop wheels are provided, and Vickers hydraulic brakes are a standard fitting. The machine is provided with a tail wheel instead of the old-fashioned skid.

The performance of the "Viastra" varies slightly according to the number and type of the power units employed. When fitted with a Bristol "Jupiter X.F. BM" engine developing 595 b.h.p. at 2,200 r.p.m., the single-engined machine has an all-up weight of 10,060 lb., the pay load being 2,600 lb. At sea level its maximum speed is 125 m.p.h., and this is increased to 145 m.p.h. when an altitude of 4,920 ft. is reached. This height is attained in nine min., the machine having an initial rate of climb of 530 ft. per min. The absolute ceiling is 21,000 ft. and the landing and cruising speeds are 60 m.p.h. and 122 m.p.h. respectively, while the 210 gallons of petrol carried in the tanks give the machine a range of 830 miles.

By the use of an Armstrong Siddeley "Leopard" engine developing 845 h.p. at 1,870 r.p.m. these performance figures may be slightly improved upon, the speed at sea level then becoming 149 m.p.h., which drops to 146 m.p.h. at a height of 4,920 ft. Only 7½ minutes are required to reach this altitude. The cruising speed when fitted with this engine is 127 m.p.h. and the range with full tanks is 850 miles. If desired, a Bristol "Jupiter XI. F" or an Armstrong Siddeley "Panther IIa" engine may be fitted in place of the engines already mentioned.

The twin-engined version, when fitted with two "Jupiter X.F. BM" engines, has an all-up weight of 12,350 lb. The speed at sea level is 148 m.p.h. and at 4.920 ft. is 160 m.p.h. The initial rate of climb is 1,050 ft. per minute and this enables the cruising ceiling to be reached in 4½ minutes. The absolute ceiling is 22,000 ft. The machine in this form can cruise comfortably at 140 m.p.h. and is capable of maintaining an altitude of 6,300 ft. with one engine out of commission. The range with full tanks is 475 miles. Alternative engines that may be used to give the "Viastra" a similar performance include the Bristol "Jupiter XI. F," the Armstrong Siddeley "Panther 11a," the Pratt and Whitney "Hornet" and the Gnome-Rhone K.14.

When three power units are to be fitted to the "Viastra," Armstrong Siddeley "Double Mongoose" engines developing 350 h.p. at 2,200 r.p.m., or Bristol "Jupiter XI. F.M" engines, each developing 500 h.p. at 1,780 r.p.m., are usually employed. The "Jupiters" are the more powerful, and give the machine a maximum speed of 152 m.p.h. The cruising speed is 130 m.p.h.

S.R. Brighton Line Electrification

An event of exceptional importance was the opening on 17th July of the extension of the Southern Railway's electric services from Coulsdon to Reigate and Three Bridges on the main line to Brighton. As compared with the former steam service, the number of trains has been greatly increased while the running time has been considerably reduced. The new rolling stock that has been provided conforms to main line standards.

A central control station has been built at Three Bridges and eighteen sub-stations have been erected along the line. These sub-stations require no staff to attend to them but are controlled from the central station.

The opening of this stage makes a total distance of 30 miles of the main line from Victoria and London Bridge electrified. The Company is energetically pushing on with the electrification of the remaining 21 miles to Brighton and of the 10½ miles extension to Worthing. It is expected that these will be ready for opening early next year.

Improved Working on the Lickey Incline

The steepest gradient on any British main line is that of 1 in 37 on the famous Lickey Incline on the former Midland line between Cheltenham and Birmingham. As almost all the trains ascending this incline have to have "banking" assistance, special arrangements have to be made for its working. Recently a series of improvements have been carried out, including the provision of a new lie-by siding for banking engines at Blackwell, and the installation of more efficient signalling apparatus. The result has been to increase the traffic capacity of the Lickey Incline for passenger and freight trains by 40 per cent. and to reduce train delays by 57 per cent.—a praiseworthy achievement in view of the heavy character of the traffic that passes over this route.

Irish Accelerations

In the article on the new compound express locomotives for the G.N.R. of Ireland, which appeared on p. 600 in last month's *"M.M."*, it was stated that these powerful engines had been built to operate the accelerated services between Dublin and Belfast. It deserves to be widely known that these services include 20 daily runs at speeds of 54 m.p.h. and over, start to stop. The fastest of them is that of the 3.15 p.m. express from Dublin which makes the run of 54.3 miles to Dundalk in 54 min., so averaging 60.3 m.p.h. The next fastest runs are two from Drogheda to Dublin—31.7 miles in 32 min., averaging 59.4 m.p.h. These are highly meritorious timings as the road is by no means an easy one, having some stiff gradients and several severe slacks. It is already clear, however, that the new engines in the hands of their competent drivers are fully capable of performing all that is required of them.

L.N.E.R. Locomotive News

Three more 0–6–0 freight locomotives of the J39 class have been completed at Darlington. They bear the numbers 2978, 2979 and 2980.

A reader reports that on a recent day he saw one of the newest express engines of the "Hunts" series—No. 247 *"The Blankney"*—at Sheffield (Victoria) Station. It looked very smart and was taking a train to York where it is stationed.

The older "Shires" continue to add to their laurels, and the "*Yorkshire*" recently brought a train of 480 tons from Darlington to York, a distance of 44.1 miles, in 48 min. 40 sec., only 40 sec. over schedule.

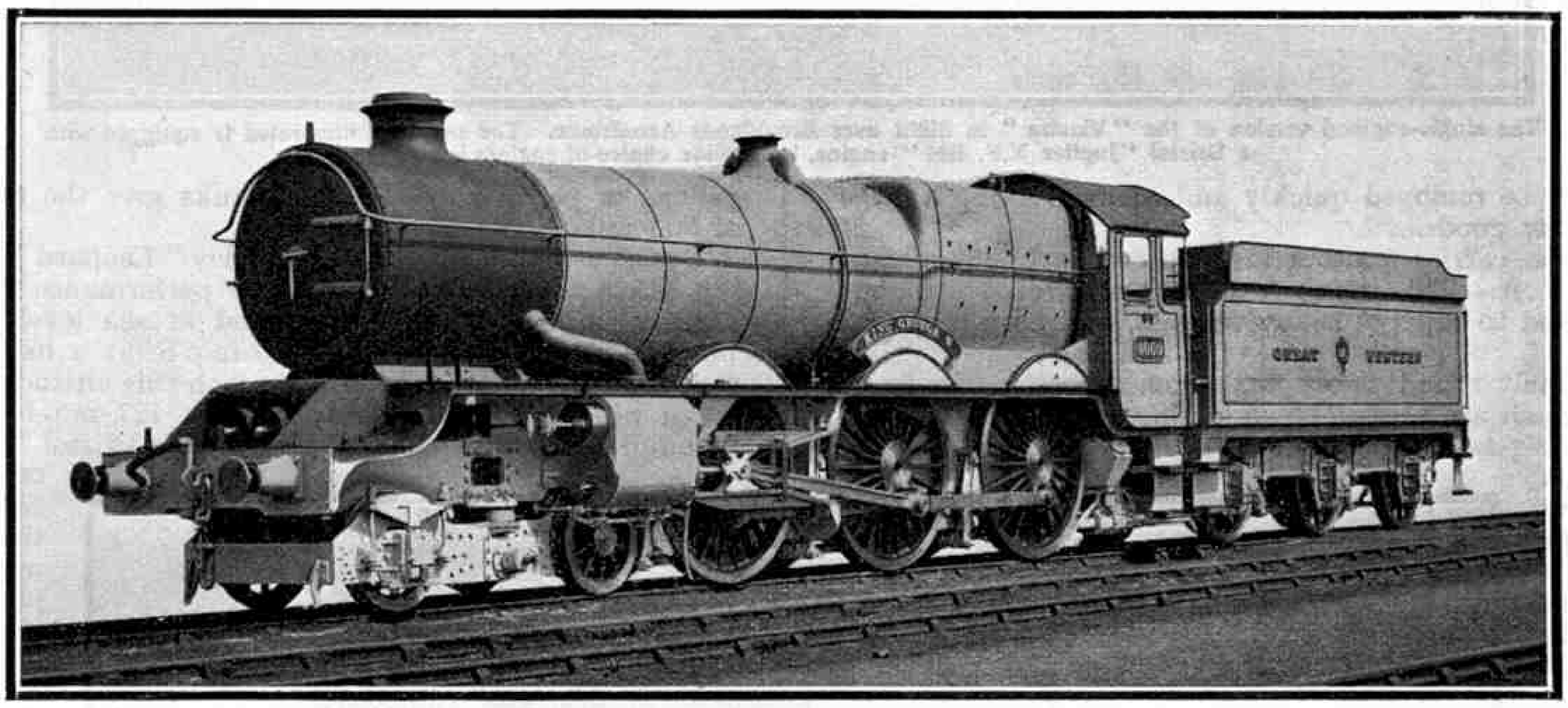
L.M.S.R. Locomotive News

The order for 55 standard 0–8–0 freight locomotives upon which Crewe Works have been engaged for some months past has now been completed and Nos. 9669 to 9674, the last of the batch, have been passed into traffic. The final three—Nos. 9672-4 are equipped with "A.C.F.I." feed-water heating apparatus.

From Derby works some new standard 2–6–4 tank engines have been turned out. They are numbered from 2375 to 2382 and have been sent to Watford for working suburban traffic on the former L.N.W.R. lines in the London area. In addition, four of the earlier engines of this class have been transferred from the Midland division to Watford. These are numbered 2306-9. In the new engines the rivets used in the tank sides and several other parts have rounded heads instead of flush ones as in the earlier engines. The appearance of the rows of round heads is quite pleasing.

Several of the reconstructed "Claughtons" or "Baby Scots" have been finished and Nos. 5959, 5974, 5985 and 5987 have been noted in service. In the opinion of many, these are the smartest-looking engines on the L.M.S.R. and they are certainly great favourites with their drivers.

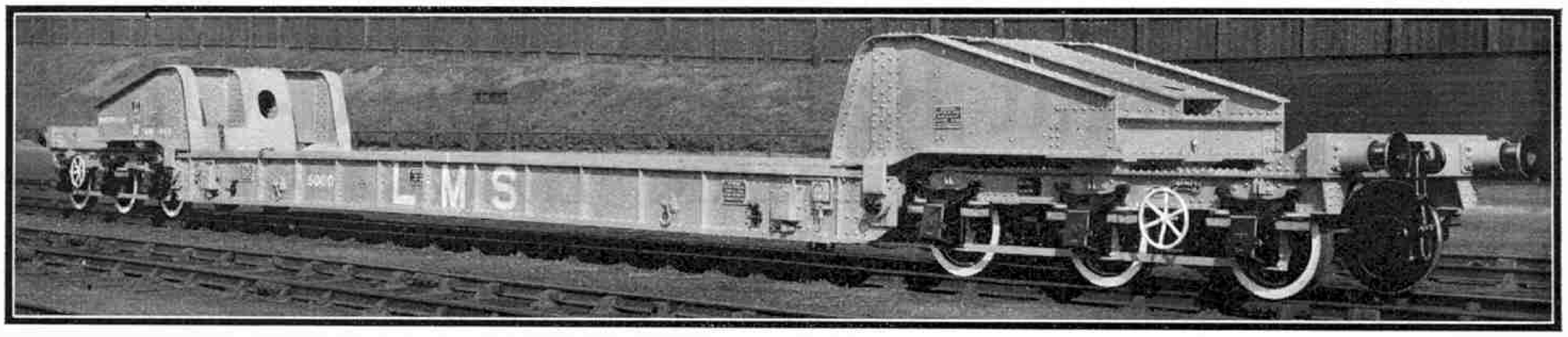
Four more 2–4–0 "Jumbos" have passed to the scrap heap:—No. 5000 *"Princess Beatrice,"* No. 5005 *"Pitt,"* No. 5069 *"Penrith Beacon"* and No. 5070 *"Wheatstone."* Beside *"Hardwicke,"* which is to be preserved, only seven of these famous engines now remain and probably some of these will have gone to their fate before these words appear in print.



G.W.R. 4-6-0 locomotive No. 6000 "King George V," the first of the famous "King" class, which are the most powerful passenger engines in Great Britain. These locomotives are remarkable for their haulage capacity on long-distance high-speed runs.

Café Cars on the G.W.R.

Two café cars, fitted with open buffet counters, have been put into service on certain G.W.R. trains. Passengers may obtain refreshments at the counters and there is also accommodation at tables.



Above appears a high-capacity trolley wagon built by the L.M.S.R. to whom we are indebted for the photograph. It is used for the transport of locomotives for service overseas, and they are loaded on and off the end of the main beams, the bogies and end cantilever sections being removable to allow of this, while hydraulic jacks support the beams and their load.

Trolleys for Locomotive Transport

The upper illustration on this page shows one of the two 65-ton trolleys recently constructed by the L.M.S.R. They have been specially designed for the transport of locomotives for shipment abroad, and special arrangements are made whereby these may be off-loaded from the ends of the wagons. This is effected by making the wagons in detachable sections. The main beams section, which carries the load, is suspended from the two end cantilever sections, each of which is carried on a six-wheeled bogie. High-tensile steel hangers support the beams, and connection is made by means of steel pins at each corner of the well.

The main beams section is so arranged as to clear the locomotive running gear and support the load within the limits of the loading gauge. Steel castings reinforce the ends of the beam sections, and rolled steel crossbars are fitted with two hydraulic jacks at each end so that the beam and its load is supported when the bogie and end cantilever section have been removed. The rails mounted on the beams for the reception of locomotives are arranged to be adjustable for different gauges.

Buffing and draw-gear is carried on the bogies themselves, and each has a high-power screw brake with equalising arrangements to the six wheels.

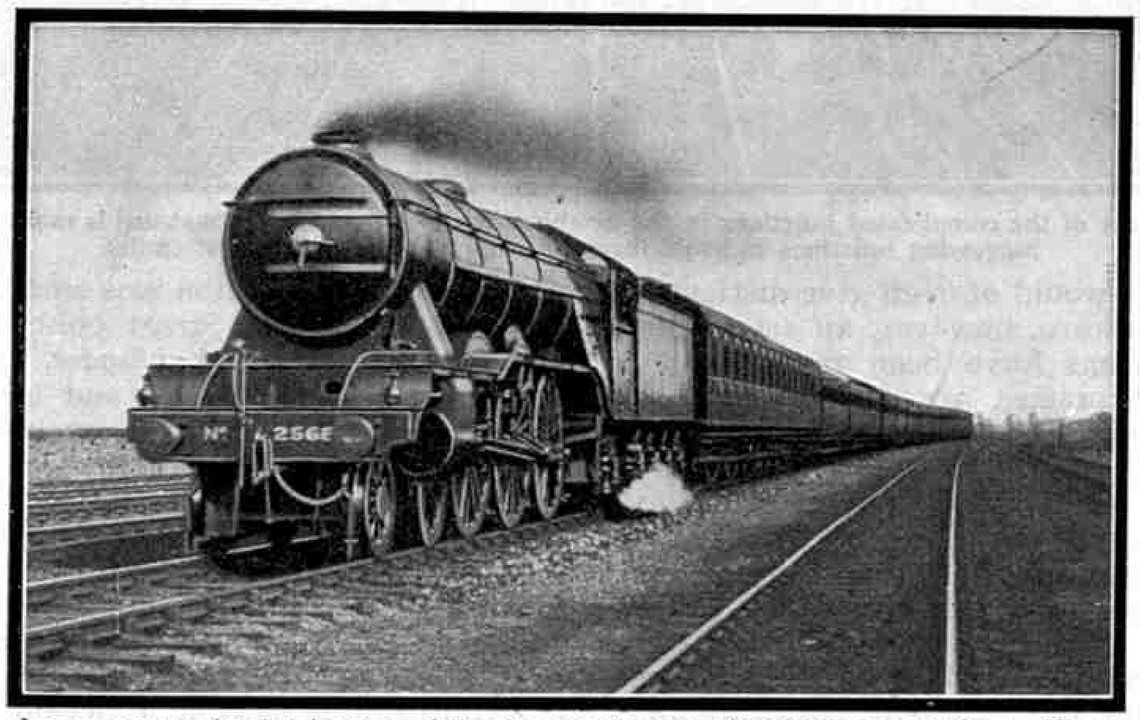
The Scottish Non-Stops

The wealth of accelerations provided by the railways this summer has tended to rob the famous Scottish expresses of some of their distinction and has diverted to other trains some of the interest that usually centres in them. Yet, actually, their glory has not been dimmed for their schedules also have been quickened and their rolling stock is more luxurious than ever.

Commencing on Monday, 18th July, the L.N.E.R. *"Flying Scotsman"* was provided with new first and third-class carriages. The first-class compartments offer the utmost degree of comfort and their appearance is most artistic and refined. The third-class compartments, too, show a distinct advance in travel comfort. Only three passengers are accommodated on each seat instead of the usual four, and arm-rests are provided for each passenger. In all the compartments the side doors have been dispensed with and large side windows provided. The compartment walls are panelled with a specially designed "Stipplex" Rexine—instead of the usual wood—the colours being chosen to harmonise with the upholstery. The running of the new vehicles at all speeds is remarkably smooth and steady.

On Monday, 18th July, when the inaugural non-stop runs for the season were made, the north-bound *"Flying Scotsman"* was drawn by locomotive No. 4472 *"Flying Scotsman."* The journey of 392.7 miles from King's Cross to Edinburgh was actually made without an intermediate stop and at one point near Dunbar a speed of 83 m.p.h. was attained. The new schedule allows 7½ hours for the journey, and Edinburgh was reached 3½ min. ahead of time. The south-bound *"Scotsman"* made a similarly good run, the engine being No. 2795 *"Call Boy."*

The L.M.S.R. *"Royal Scot"* expresses in both directions also made auspicious runs on the same day. The 10 a.m. from Euston looked palatial as it moved out for the North to the accompaniment of music from four pipers. The train was made up of 13 coaches and was pulled by locomotive No. 6100 *"Royal Scot"* which was decorated with the Scottish arms surrounded by flags. The train reached Carlisle four minutes before time and was still ahead of the new timetable at Glasgow and Edinburgh. In the opposite direction, the sister train also covered the 400-mile journey ahead of schedule. It is quite clear, therefore, that the new schedules do not unduly tax the power of the locomotives even when comparatively heavy loads are taken.



An up express hauled by one of the famous Gresley "Pacific" locomotives. These well-known engines have charge of practically all the chief L.N.E.R. expresses, including the "Flying Scotsman," the "Queen of Scots" and other famous trains.

Heavy Holiday Traffic

The August holiday season is the busiest time of the year on the railways of Britain and in the course of the recent Bank Holiday week-end more than 10,000,000 holiday makers had to be provided with swift, safe and comfortable transport. The busiest day of all was the Saturday of that week-end. Most of the leading expresses on all the railways had to be run in duplicate and, in some instances, in triplicate. Excited crowds thronged the principal stations and especially the great London termini. The rush was, perhaps, at its greatest at Waterloo where nearly 250 additional trains were put on during the week-end. A unique feature was the provision on the Saturday morning of seventeen boat trains to carry to Southampton more than 6,000 passengers who were sailing by the fourteen great ocean liners that were leaving the port on that day. Five of the Empire's biggest ships—the *"Empress of Britain," "Aquitania," "Homeric," "Olympic"* and *"Berengaria"*—were included in this peaceful armada, beside the even bigger American liner *"Leviathan."*

Railway Routes between London and Manchester

A correspondent writes in praise of the acceleration of the *"Mancunian"* and says that it will be greatly appreciated by business men in particular, and the enterprise of the L.M.S.R. will doubtless have its reward. He suggests, however, that for people to whom time is less pressing, the other routes between London and Manchester will still make a strong appeal. The scenic beauty of the L.M.S.R. Midland route through the Peak District is worth making the journey to see. The writer had himself recently travelled to Manchester and back by the Great Central route from Marylebone. That route also passes through much attractive scenery and the final stage includes the romantic climb through the Pennines before the swift dash down into Manchester. The expresses on this line are very tightly timed and the heavy gradients demand some of the smartest engine work that is performed in this country. Going down, our correspondent travelled behind a 4–4–0 "Director"—No. 5504 *"Jutland"*—all the way to Manchester. In returning he had a variety of locomotives:—a G.N.R. "Atlantic," No. 4412, from Manchester; an inside cylinder G.C. 4–6–0—No. 5426 *"City of Chester"*—from Sheffield; and a "Director," No. 5437 *"Prince George"*—from Leicester.

The Great Railway Speed-Up

Superb Running by L.M.S.R. *"Liverpool Flyer"*

By "Observer"

IN railway history there are certain years that stand out with distinction because of the noteworthy feats of speed or remarkable accelerations that were witnessed in them. Thus 1888 will be ever memorable as the year of the Railway Race to Edinburgh. Mr. E. Foxwell, in that lively book *"Express Trains,"* aptly called it "that impetuous year." Seven years later, in 1895, came the greater Race to Aberdeen with its days and nights of thrills, when, over a longer course, decidedly higher speeds were attained. The year 1904, again, was styled "a great Railway Year," and well-merited that description. Something like a "Race from the West" came about as the G.W.R. and L.S.W.R. competed keenly for the ocean mail traffic between Plymouth and London, and records were then established by the G.W.R. that were not surpassed until last year. One, indeed, the 102.3 m.p.h. record of the *"City of Truro,"* remains still unbeaten. In that year, too, the non-stop run between Paddington and Plymouth was put on by the G.W.R., and on other lines some striking accelerations were made, including timings between London and Manchester of 3 hr. 30 min. by the L.N.W.R. route, and 3 hr. 35 min. by the Midland.

And now in 1932 we are certainly living in another red-letter year so far as railway speeds and accelerations are concerned. The record run of the G.W.R. *"Cheltenham Flyer"* from Swindon to Paddington at an average speed of 81.6 m.p.h.—as fully recorded in last month's *"M.M."*—would of itself give distinction to the year. As readers are well aware, however, an astonishing number of really sharp accelerations have been made by our railway companies, and many expresses are now running at average speeds that show a marked advance on anything attempted before.

Among the accelerations that came into force on Monday, 18th July, the foremost honours must be accorded to those on the L.M.S.R. So drastic, indeed, were some of the new schedules that in some quarters doubts were expressed as to the ability of the locomotives to observe them. Any such fears were effectively dispelled by the performances achieved on the first day of the new timings. On that day, the up *"Mancunian,"* loaded to 375 tons and drawn by engine No. 6165 (an unnamed "Royal Scot,") arrived at Euston 6¾ min. before time, having accomplished the non-stop journey of 177 miles from Wilmslow in 165¼ min., giving an average speed of 64.2 m.p.h., start to stop. The two closely-following expresses also arrived in advance of their new tight schedules. The one from Birkenhead, North Wales and Blackpool, due at 1.15 p.m., and made up of 13 coaches with engine No. 6146 *"Jenny Lind"* at the head, ran in 4 min. before time, having covered the 158.1 miles from Crewe in 156 min. The up *"Merseyside Express,"* consisting of 11 coaches, was brought in by engine No. 6143 *"Mail,"* 4¼ min. early.

The smartest run of all was made by the up express, leaving Liverpool (Lime St.) at 5.25 p.m. and booked to run from Crewe to Willesden, 152.7 miles, in 142 min. In this case the load behind the tender was 295 tons—nine coaches—and the engine No. 6140 *"Hector,"* of the "Royal Scot" class. Although the schedule of the train calls for an average speed of 64.5 m.p.h. this was so far improved upon that an arrival fully 5 minutes early was made and the run accomplished at an average of 66.9 m.p.h. A correspondent who travelled on the train has kindly favoured me with his log. From Crewe, Whitmore (10.5 miles) was passed in 12½ min., Stafford (24.5 miles) in 24¾ min., Rugby (75.5 miles) in 71 min., Bletchley (111.4 miles) in 101½ min., and Willesden was reached in several seconds short of 137 min.

Not until the second week after the new timing came in was I personally able to test the running of this now famous train. Going down to Liverpool by the 10.40 a.m. from Euston, I noted some first-class work by the locomotive—No. 6144 *"Ostrich"*—and its crew, Driver R. Taylor and Fireman S. Mead, of Edge Hill shed. With a load of 12 coaches—385 tons—59 miles were covered within the first hour from the start, including the stiff pull out of Euston and the ensuing steady rise to Tring. Approaching Nuneaton we were 2 min. before time and were checked by signals at Attleboro' box, but arrived at Stafford 2¼ min. early. Leaving Stafford 1 min. 25 sec. late, with a load reduced to seven coaches, we made brisk running and reached Lime Street on the stroke of time at 2.15 p.m. That was a distinctly good run, but the return trip from Liverpool to London was simply superb, as I shall go on to show.

A view of some of the complicated junctions in the neighbourhood of Camden. Great use is made of flying and burrowing junctions to avoid the conflicting of different kinds of traffic.

Leaving Lime Street punctually at 5.25 p.m. our engine, No. 6105, *"Cameron Highlander,"* a "Royal Scot," of course, with Driver R. G. Hemeley and Fireman G. Sorrell, of Camden shed, in charge, was called upon immediately to exert its full powers. The train consisted of thirteen coaches, weighing 415 tons; and as there was no banking engine, it meant strenuous pulling up the severe gradients—1 in 83 and 1 in 93—that obtain from Lime Street to Edge Hill. Up this ascent we were taken in resolute style, but the first 1½ miles occupied almost 5 min. Down the falling grades through Sefton Park and Mossley Hill acceleration was rapid, and at Halebank we were doing 75 m.p.h. Approaching Ditton Junction we were slacked and at reduced speed we climbed to the massive bridge that spans the Mersey and Manchester Ship Canal at Runcorn. Six miles farther on, at Weaver Junction, we joined the main line from Carlisle and Scotland and, still making good running, at Acton Bridge we were well on time. Approaching Hartford, however, we found signals "on" and had to come almost to a standstill before we got the line clear. At Winsford signals were again adverse and we were reduced to the merest crawl. The fact was that the 1.28 p.m. stopping train from Carlisle, which was due at Crewe at 5.56 p.m., was running late and so blocking our way. The result was that we took 24 min. 25 sec. for the 14.4 miles from Acton Bridge to Crewe, where we arrived 7½ min. late.

Two-and-a-half minutes, instead of the booked four, sufficed for station duties at Crewe, including the uncoupling of the rear

This photograph, reproduced by courtesy of the L.M.S.R., shows the 5.25 p.m. "Liverpool Flyer" with the "Royal Scot" locomotive No. 6140 "Hector," at its head.

three coaches whose destination was Birmingham. So, with a train of 10 well-filled coaches—one more than on the first day of the new schedule—weighing 320 tons, we got away 6 minutes late for our strenuous dash to Willesden. The early delays had been somewhat disconcerting as, naturally, I was eager to get a really good run, but there was still hope. I recalled that we had passed through a sharp storm at Runcorn and against a black cloud a bright rainbow had shone! And as it proved, those vexatious delays provided just the needful incentive and opportunity for our driver and his mate to show what they and their splendid steed could do on this memorable occasion.

Up the long, steadily-rising gradients to Whitmore nothing noteworthy was achieved. At Betley Road we were doing 56 m.p.h., at Madeley, 58 m.p.h. Not until Whitmore was reached did we attain 60 m.p.h., and for the 10.5 miles, 13 min. 25 sec. had been taken. Down the easy slopes beyond, speed rose to 76 m.p.h. but was reduced to 65 m.p.h. in passing Norton Bridge. Thereafter it rose to 73.7 before we had to slack to 36 m.p.h. for the junction and long curve at Stafford. Quickly gathering speed again we swept onward through Colwich at 70 m.p.h., and on the dip before Rugeley attained 75 m.p.h. Lichfield (41.8 miles from Crewe) was passed in 39 min. 58 sec., and at Hademore troughs beyond, we were speeding at 80.3 m.p.h. Tamworth was passed at 77.5 m.p.h., but soon afterwards the brakes went on and speed was reduced for the observance of the slack necessary because of colliery workings at Polesworth. The minimum touched was 40 m.p.h., but so cautious was the running here that, although Polesworth station is 106.5 miles from Euston, yet even between mile-posts 105 and 104, 75 secs. were occupied, showing an average of 48 m.p.h.

Through Atherstone, Nuneaton and Bulkington speed ranged round about 65 m.p.h., but on the favourable grades through Shilton and Brinklow it rose once more to 75 m.p.h. before steam had to be shut off for the slack through Rugby. This again was most carefully observed, and we passed the centre of the long station in 70 min. 12 sec. from leaving Crewe, the distance being 75.5 miles. Up the adverse grades beyond speed gradually increased, and when we entered Kilsby tunnel we had attained 58 m.p.h. and this had increased to 61 m.p.h. when we left the tunnel. Descending grades now helped our pace and between Welton and Weedon for a mile-and-a-half we sped along at 81.8 m.p.h. The rise to Roade brought us down well into the seventies, but on the gentle descent beyond we touched 80 once more. Passing Bletchley at 76 m.p.h. we entered on the steady climb of 15 miles up the slopes of the Chilterns to the summit at Tring. It was astonishing to find how the speed was sustained on these grades. At Leighton Buzzard it was 75 m.p.h.; at Cheddington it was 72, and even at the summit the minimum was 68. Thus the 15 miles from Bletchley to Tring, all uphill, occupied only 12 min. 15 sec., giving an average of 73.5 m.p.h. The working timetable allows 14 min. for this stage, but we had bettered that exacting booking by 1¾ min.

And now, remarkable to tell, we were 40 sec. ahead of time, in spite of our 6 min. late departure from Crewe, having done the 126.4 miles in 112 min. 20 sec. Before us lay an easy road, falling gently almost all the way to London, and there was an encouraging prospect of an early arrival—how early remained to be seen. At Berkhamstead our speed was 76.2 m.p.h. but just as we were anticipating 80 and more, the grinding of brakes was heard and felt, and speed fell lower and lower until it was only 20 m.p.h. At Boxmoor permanent-way relaying was proceeding and so a long slack was necessary. Once all was clear, however, our driver swung ahead again, the fireman piled on more coal, and with commendable enterprise every effort was made to secure even yet a punctual arrival. Through King's Langley we were travelling at 68 m.p.h. and speed continued to rise consistently until beyond Harrow we exceeded 80 m.p.h. This high speed was sustained until at milepost 7 the brakes were applied and a very sharp, but at the last, very gentle, stop was made at Willesden, the final 2.7 miles from Wembley having occupied only 2 min. 40 sec. The overall time for the 152.7 miles from Crewe to Willesden was 136 min. 20 sec., giving an average speed of 67.2 m.p.h., start to stop.

Half-a-minute saw us away from Willesden, and 9 min. 40 sec. later we drew up at Euston, fully half-a-minute before our scheduled arrival time of 8.45 p.m.

On leaving the train at Euston I at once hurried forward to shake most heartily the black, oily hand of Driver Hemeley and congratulate him and his fireman on their (*Continued on page 726*)

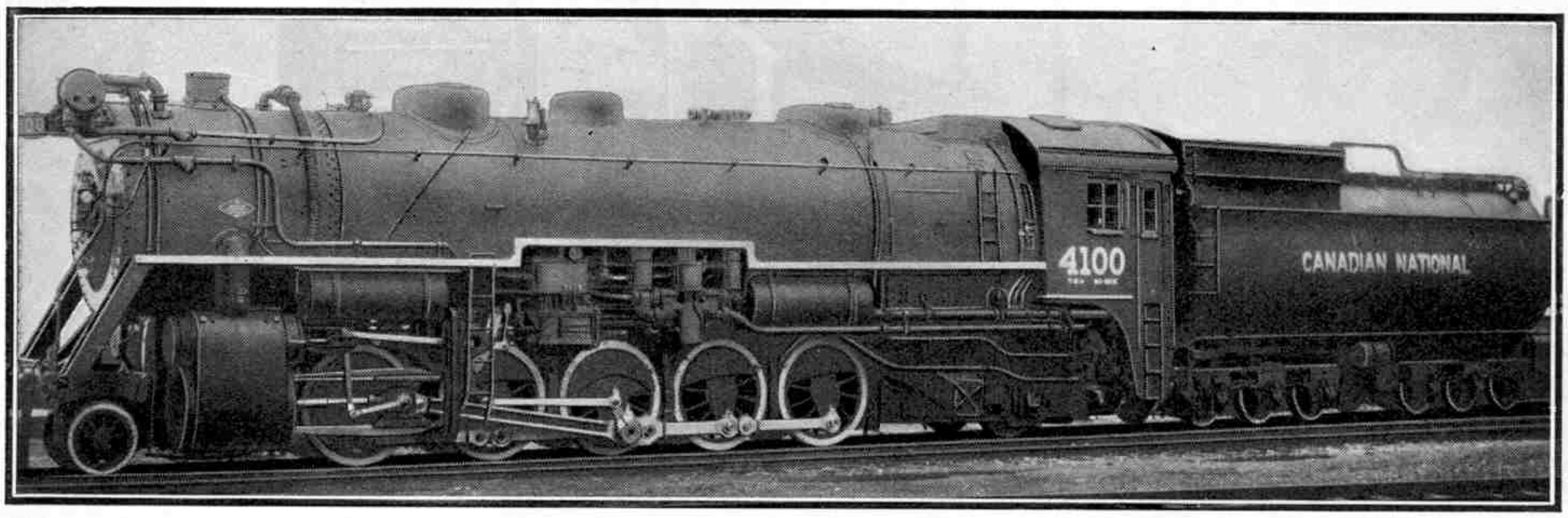
Log of the "*Liverpool Flyer*"

Distance Miles	Schedule Min.	Stations		Time Min.	Time Sec.
0·0	0	Crewe	dep.	0	0
10·5		Whitmore	pass	13	25
19·2		Norton Bridge	,,	20	33
24·5	26	Stafford	,,	25	03
33·8		Rugeley	,,	33	55
41·8		Lichfield	,,	39	58
48·1		Tamworth	,,	44	38
51·6		Polesworth	,,	48	05
55·8		Atherstone	,,	52	30
61·0	60	Nuneaton	,,	57	15
70·0		Brinklow	,,	65	15
75·5	73	Rugby	,,	70	12
88·4		Weedon	,,	82	20
95·3		Blisworth	,,	87	40
98·2	94	Roade	,,	90	05
111·4	105	Bletchley	,,	100	05
117·9		Leighton Buzzard	,,	105	12
126·4	119	Tring	,,	112	20
133·6		Boxmoor	,,	119	10
140·7		Watford	,,	126	25
150·0		Wembley	,,	133	40
152·7	142	Willesden	arr.	136	20

(Speeds are given in article)

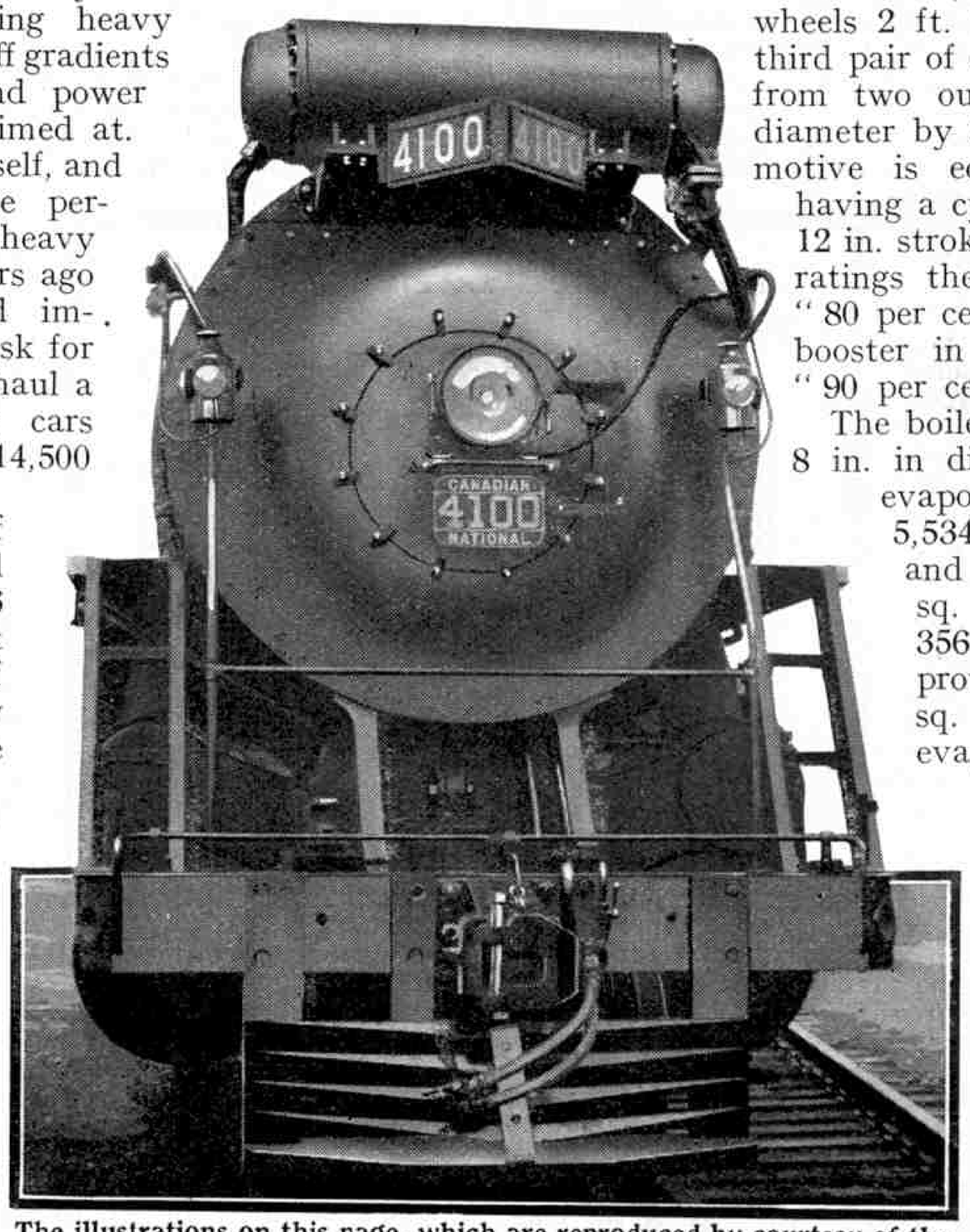
C.N.R. Giant Freight Locomotives

The 2-10-2 Type "4100" Class



THE accompanying illustration shows No. "4100," the first of a series of Santa Fé type locomotives in the service of the Canadian National Railways. These are the largest locomotives of this type in the British Empire. They were designed primarily for hauling heavy freight trains over the rather stiff gradients into and out of Toronto, and power rather than high speed was aimed at. This policy has fully justified itself, and the "4100" locomotives are performing everyday tasks in heavy freight haulage that a few years ago would have been considered impossible. It is an ordinary task for one of these great engines to haul a train of 150 loaded freight cars representing a total of about 14,500 tons of freight.

When the first locomotive of this series was tested it hauled a fully loaded grain train of 56 cars representing a total weight of 4,295 tons, for a distance of 236 miles through the Rocky Mountains. This is said to have been the heaviest train ever hauled through the Rockies by a single locomotive on any railway. In addition to grain cars there were two business cars, a caboose or conductor's car, and a dynamometer car equipped with apparatus to record and check the performance of the new locomotive. The results of this severe test were so satisfactory that further engines of similar design were put in hand almost immediately.



The illustrations on this page, which are reproduced by courtesy of the C.N.R., give an excellent idea of the vast size of the "4100" class locomotives. The lower photograph is particularly striking, and shows clearly the central coupler, the headlight, and the feed-water heater.

No. "4100" with tender has an overall length of 92 ft. and is 15 ft. 3 in. in height and 10 ft. 8 in. in width. It is of the 2–10–2 wheel arrangement, and has five pairs of driving wheels, of which the coupled wheels are 4 ft. 9 in. in diameter, and the leading truck wheels 2 ft. 7¼ in. in diameter. The third pair of coupled wheels are driven from two outside cylinders, 29 in. in diameter by 32 in. stroke. The locomotive is equipped with a booster having a cylinder of 10 in. bore and 12 in. stroke. In Canadian National ratings the engine is known as an "80 per cent." engine, and with the booster in operation it becomes a "90 per cent." engine.

The boiler of No. "4100" is 8 ft. 8 in. in diameter, and has a total evaporative heating surface of 5,534 sq. ft., of which the tubes and flues account for 5,178 sq. ft. and the fire-box for 356 sq. ft. The superheater provides an additional 1,558 sq. ft., so that the total evaporative heating surface is 7,092 sq. ft. The working steam pressure is 200 lb. per sq. in. In working order the locomotive weighs 328 tons, and it is capable of developing 3,200 h.p.—a greater amount of energy than is distributed from the power plants of many towns.

The tender is of the barrel-shaped pattern so often used in Canada and America.

Giant Simple-Expansion "Mallets"

Coal Haulage over Allegheny Mountains

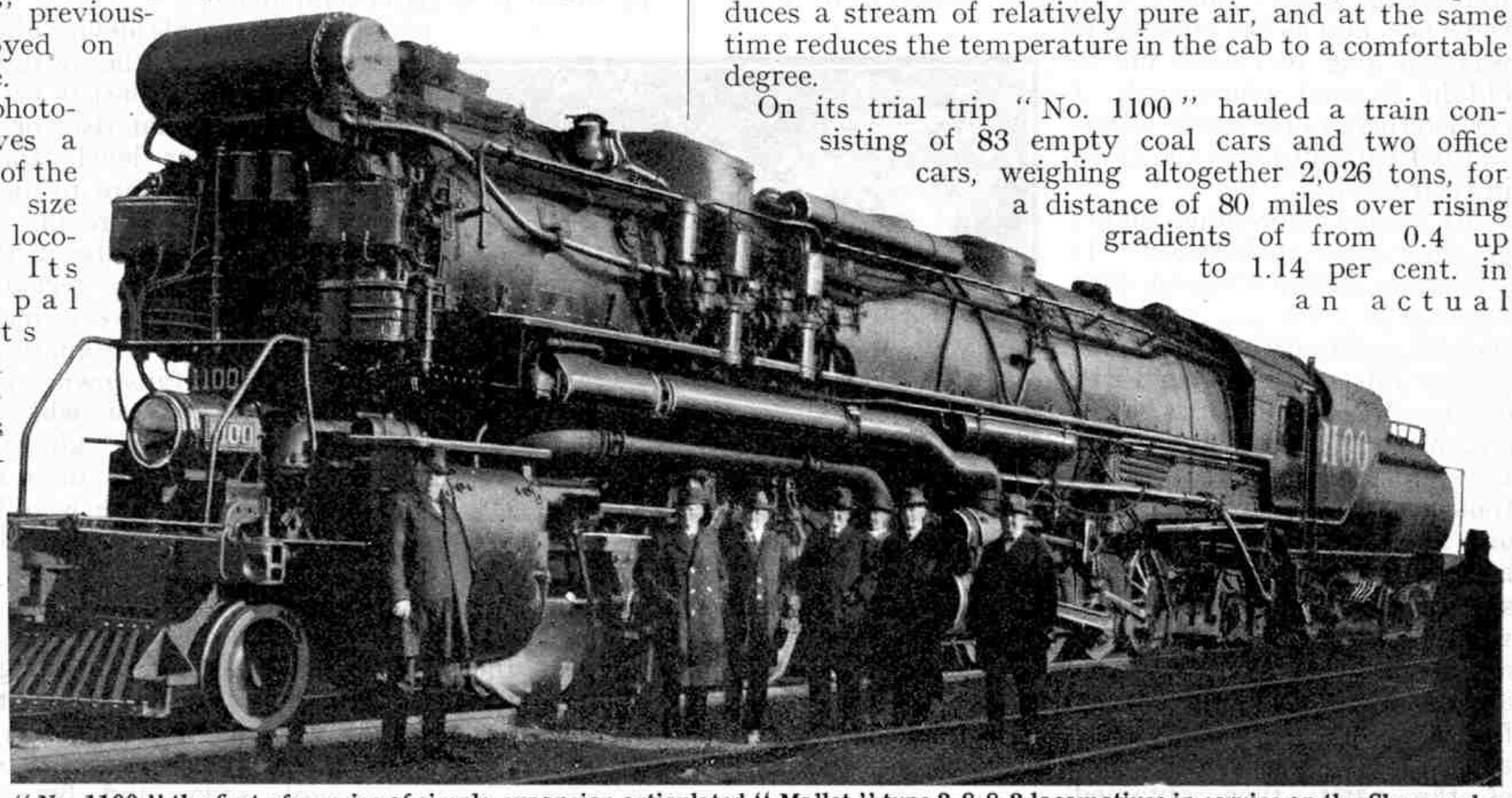
OUR illustration shows "No. 1100," a simple-expansion articulated "Mallet" type 2–8–8–2 locomotive in use on the Chesapeake and Ohio Railroad, U.S.A. This locomotive was the first of 25 of this type built by the American Locomotive Company, to deal with heavy coal trains over the steeply-graded main line that crosses the Allegheny Mountains. They were the first simple "Mallets" of the kind to be constructed, and they superseded the 2–6–6–2 compound "Mallets," previously employed on this route.

The photograph gives a good idea of the enormous size of the locomotive. Its principal weights and dimensions are:—total length, engine and tender, 109 ft. 3⅜ in.; total wheel-base, 98 ft. 0⅜ in.; total weight, engine and tender in working order, 775,000 lb., or approximately 346 British tons; tractive effort at 85 per cent. boiler pressure 103,500 lb.; tender capacity, 12,000 gallons of water and 15 tons of coal. The four cylinders are each 23 in. in diameter, with a stroke of 32 in. The 12 in. piston valves are worked by Walschaerts gear for inside admission, controlled by an Alco reversing servo-motor. The maximum cut-off is 85 per cent.

The immense volume of steam required by this engine demands a correspondingly large boiler. Its rated horse-power is 3,677, or 94 per cent. of the maximum cylinder horse-power, and it is designed to produce over 81,000 lb. of steam per hour. The fire-box is 8 ft. 0¼ in. in width, and 17 ft. 0⅛ in. in length, exclusive of the combustion chamber, 5 ft. 9 in. in length. The total grate area is 112.9 sq. ft. Fuel is supplied by a duplex mechanical stoker, which is capable of feeding up to 12,682 lb. per hour, or nearly 113 lb. per sq. ft. of grate area. The total heating surface is 6,447 sq. ft.; the superheating surface is 1,885 sq. ft., and the working pressure is 205 lb. per sq. in.

An outstanding feature of the locomotive is its equipment of two powerful fans for eliminating tunnel gases. These were installed after exhaustive tests by the Mechanical Department in conjunction with experts from the United States Department of Interior, Bureau of Mines. The fans are situated one on the driver's side and one on the fireman's side, with the intake pipes underneath the cab decking, and intake between engine and tender. This arrangement produces a stream of relatively pure air, and at the same time reduces the temperature in the cab to a comfortable degree.

On its trial trip "No. 1100" hauled a train consisting of 83 empty coal cars and two office cars, weighing altogether 2,026 tons, for a distance of 80 miles over rising gradients of from 0.4 up to 1.14 per cent. in an actual running time of 4 hr. 42 min., averaging 17.06 m.p.h. On the return trip the locomotive hauled 4,990 tons for the first 34 miles and 3,889 tons for the succeeding 46 miles, which includes 18 miles with a gradient of 0.57 per cent. On this journey the total running time was 4 hr. 45 min.



"No. 1100," the first of a series of simple-expansion articulated "Mallet" type 2-8-8-2 locomotives in service on the Chesapeake and Ohio Railroad, U.S.A. These giant locomotives are employed to haul heavy coal trains over the steeply-graded main line that crosses the Allegheny Mountains.

The reason for the adoption of these simple-expansion "Mallet" locomotives is interesting. Heavier train loads and higher speeds demanded more powerful locomotives. Any great increase of size was prevented by the dimensions of a certain tunnel on the line, where the limits of height and width are less than obtain elsewhere on the system. Thus, had a compound locomotive been adopted the size of the low-pressure cylinders would have been severely restricted, so a design with four high-pressure cylinders and increased boiler pressure was adopted. The diameter of the boiler being limited by the loading gauge, the requisite heating surface was obtained by increasing its length; the boiler barrel is, therefore, built up of five rings.

An interesting feature is that there are actually two chimneys each taking the exhaust from one pair of cylinders.

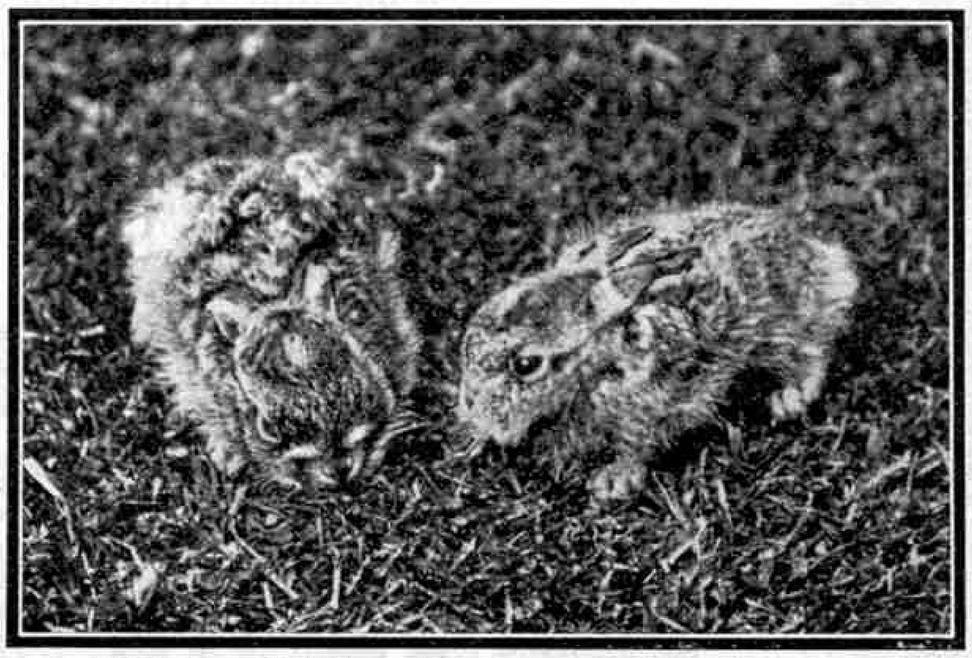
FROM OUR READERS

These pages are reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper, and they may be accompanied by photographs or sketches for use as illustrations. Articles that are published will be paid for at our usual rates. Statements contained in articles submitted for these pages are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

Wild Life Photography

I discovered the two leverets shown in one of the accompanying photographs when I was searching for a ball in the hayfield that adjoins our garden. They were lying snugly under a tussock about 12 ft. from the fence, and as the grass there was too long to enable me to obtain a good photograph, I carried them to the lawn. Afterwards I carefully replaced them in their forme.

My second photograph shows an eider duck on her nest. It was taken during a ramble with a party of local naturalists in the bird sanctuary of Tentsmuir, on the Fife shore of the Firth of Tay. A keeper acted as guide, and after telling us many interesting stories about the thousands of birds that wheeled and screamed overhead, he said he would show us an eider duck sitting on 15 eggs. He had marked the place, and when we reached it he quietly pushed the great bird off to show us the large greenish-blue eggs lying in a nest filled with eiderdown, the soft, white down from her breast. The bird settled on her nest again at the first opportunity, and I and other members of the party then obtained photographs.



Leverets taken from their forme to be photographed on a lawn. Photographs on this page by John Macnaughton, Kirkcaldy.

My visit to the bird sanctuary was memorable in many ways, but I was particularly delighted when the keeper gave me an egg of the Arctic Tern, a summer visitor to Great Britain. The egg was gathered from a deserted nest of this bird that we saw during our ramble.

JOHN MACNAUGHTON
(Kirkcaldy).

An eider duck on her nest in the bird sanctuary at Tentsmuir, Fifeshire. When this photograph was taken the bird was sitting on 15 eggs.

Water Supply at High Pressure

Some time ago I visited the Grosvenor Road Works of the London Hydraulic Power Company, which supplies water under pressure to customers in the London area who wish to use it for operating hydraulic lifts, cranes, and other machinery. The water is obtained from the Thames, and flows at high tide through pipes 20 in. in diameter into concrete reservoirs holding 2½ million gallons. After settling it is pumped into overhead storage tanks, from which it passes through gauze strainers and charcoal filters in order to purify it. It is then pumped into pipes, 8 in. and 6 in. in diameter, that run into a subway and thence under the streets to the buildings in which it is to be employed.

A simple device showing the depth of the water in the reservoirs consists of a floating canister that rises or falls with the water level, and is connected by wire to an indicator in the engine-room. The pressure of the water in the service pipes also is registered, and a special valve is incorporated that closes automatically if the pressure falls owing to a break in a pipe, or when an accident of any kind threatens to cause loss of water. In addition, there is a wonderful system of valves by means of which the supply of high-pressure water is distributed as required.

The Grosvenor Road Station is one of five that between them pump about nine million gallons of water per week. The boiler installed is fitted with a chain grate stoker, and the feed water is softened before use by adding carefully measured quantities of soda and lime. In the station there are five triple-expansion pumping engines and a Parsons steam turbine driving a Mather & Platt pump that runs at 8,000 r.p.m. and pumps 60,000 gallons per hour at a pressure of 850 lb. per sq. in. J. W. BROWN
(Wimbledon Park, S.W.19).

Stone Railway Sleepers

An interesting link with the past was revealed last year during excavations near Selby Station, for a number of stone railway sleepers were discovered that were used on the Leeds and Selby line when it was constructed in 1830-34. These sleepers are simply square blocks of stone that were placed under the rails at intervals. When supported in this manner the rails settled down unequally and this was one reason for the introduction of long wooden sleepers, passing under both lines of one track, with which we are familiar. T. STAMFORD (Selby).

Fort Denison, Sydney Harbour

Fort Denison is an interesting island in Sydney Harbour, and it owes its name to the Fort that was built on it by convict labour long ago, when New South Wales was used as a convict settlement. To-day it is one of Sydney's most attractive features.

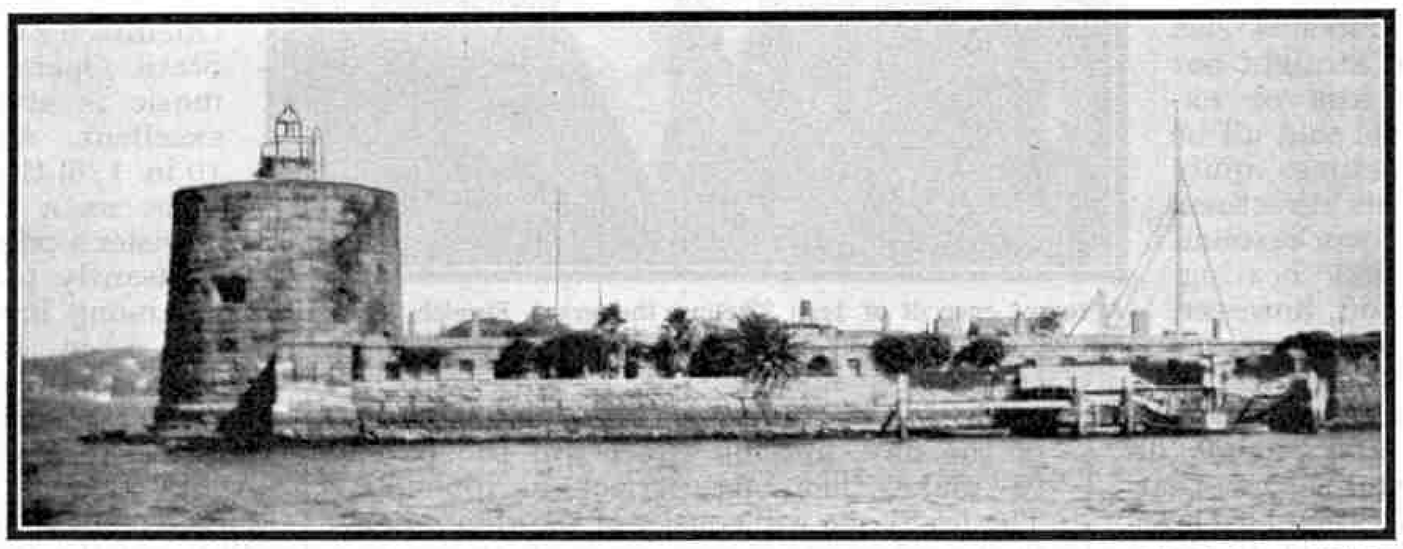
From the Harbour little can be seen of the interior of the Fort, for a stone wall surrounds the dwelling quarters of the light keeper, who with his family lives on the island. Within the wall there is a broad lawn surrounded by flower beds, even the unused gun embrasures being filled with plants; and on one side a swimming pool has been constructed. At the north end of the island is the light tower at the top of which a red light shines at night, and in the base of the tower, almost at water level, are several dungeons in which refractory members of the garrison were formerly imprisoned. Although dark and cold, the cells are well ventilated by means of a shaft that passes through 10 ft. of masonry.

The circular guard room is about half-way up the tower, and is indeed a place of relics, for on its walls hang ancient rum measures, and the original cannons of the Fort still stare menacingly down the Harbour from their ports, although their muzzles are blocked so that they are useless. A brass gong that was struck when the guard was changed, and afterwards was used as a fog warning, also may be seen.

A tide gauge is installed in a room to the left of the tower and on the wall near it are copies of tide records taken during famous earthquakes at San Francisco and in Japan. These records may be compared with charts placed alongside showing the effects of these disturbances on instruments in Sydney that detected the earth movements themselves.

The keeper has a busy time on the island, for in addition to maintaining the light in good condition he fires the one o'clock gun and looks after an aviary containing about 60 canaries and finches, in which he takes great pride. He also attends to Harbour Trust launches that call during the day to take in petrol from the stores on the island, and a diversion is caused when officials land for the purpose of checking the speeds of large vessels passing up or down the Harbour.

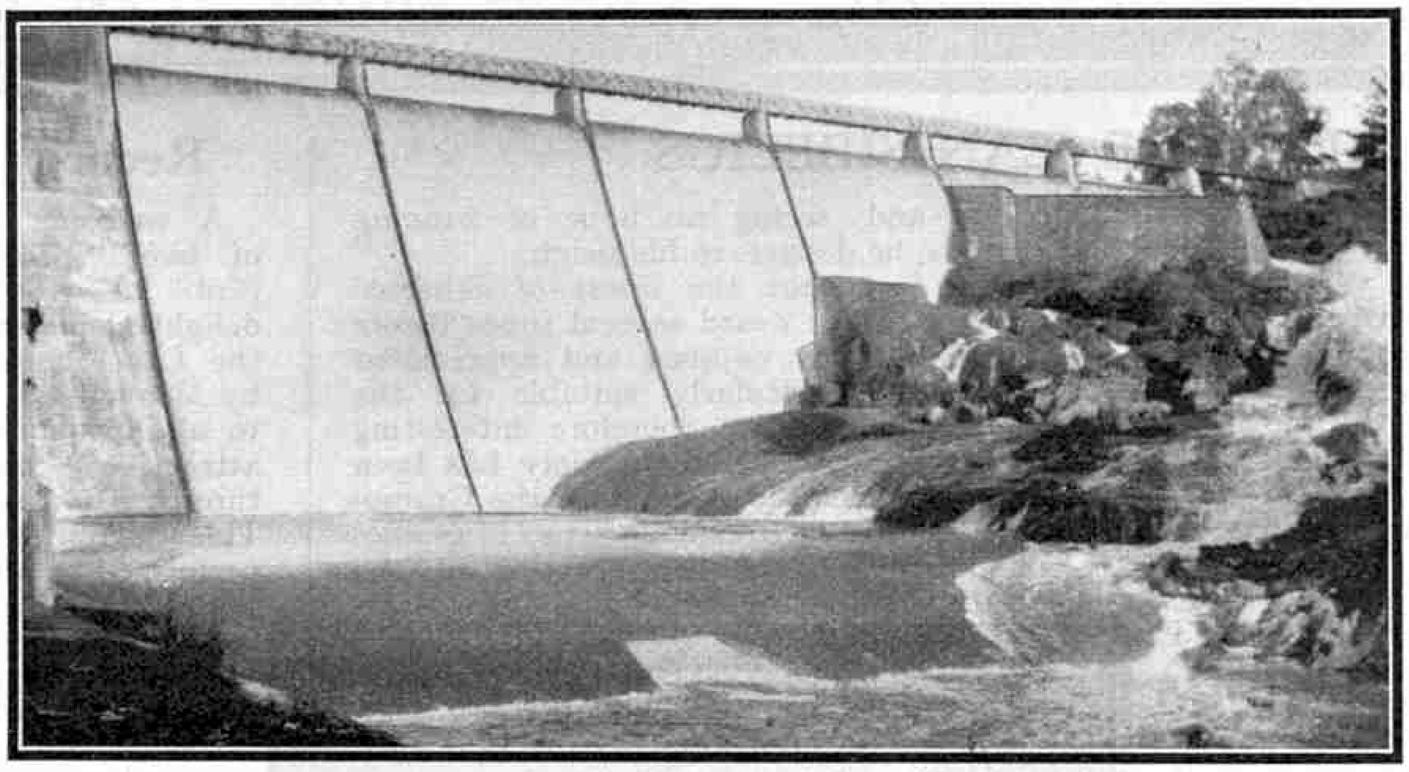
MACLEOD MORGAN (Cremorne, N.S.W.).



Fort Denison, a small island in Sydney Harbour, as seen from a passing ferry steamer. At night a red light shines from the top of the tower on the left. Photograph by M. Morgan, Sydney.

Mundaring Weir

Recently I paid a visit to Mundaring Weir. This is 25 miles east of Perth, Western Australia, and was begun in 1899 as part of what is known as the Goldfields Water Scheme. This name was given to the scheme because it provided for the supply of 5,000,000 gallons of water daily to Kalgoorlie, the famous mining centre 330 miles away. For this purpose water from the main storage reservoir is pumped through a pipe-line that follows the Perth - Kalgoorlie railway, and the line also supplies towns and farms near which it passes.



Mundaring Weir, Western Australia. The artificial lake behind this great dam is seven miles in length, and contains 4,600 million gallons of water. Photograph by R. Turner, Subiaco.

The top of the weir is 100 ft. above the bed of the river, and the water impounded forms a lake seven miles in length, containing 4,600 million gallons of water. The surface area of the reservoir at full supply level is 670 acres, and the catchment basin from which the water is collected covers 350,000 acres. The building of the weir has disturbed little of the virgin bush, and wild flowers and trees growing within half a mile of the reservoir are protected, while fir trees have been planted in the neighbourhood. R. TURNER (Subiaco, W. Australia).

Down a Purbeck Stone Quarry

A short time ago I visited the Purbeck stone quarries. These are really tunnels in the hard stone and I entered one of them by walking down rough stone steps. At the bottom I turned along a gently sloping tunnel nearly a mile in length and on arriving at the end, where the stone was being worked, I heard the noises made by the men in a neighbouring quarry.

The stone is hewed out with picks and put on heavy wooden trolleys with iron wheels that run on a stone track. Full trucks are pushed by hand to the base of the quarry opening and are then hoisted by means of a chain that is wound round a shaft at the top, a donkey turning the shaft by walking round at the end of a long pole fixed to it. Every time the donkey passes the quarry opening it looks in to see if the truck is in sight and stops immediately this can be seen.

Fossils are often found in the stone and the quarrymen sometimes discover a substance to which they give the name of "congealed water." This is really a kind of mica.

R. HUNT (Swanage).

THE MUSIC OF JEAN SIBELIUS

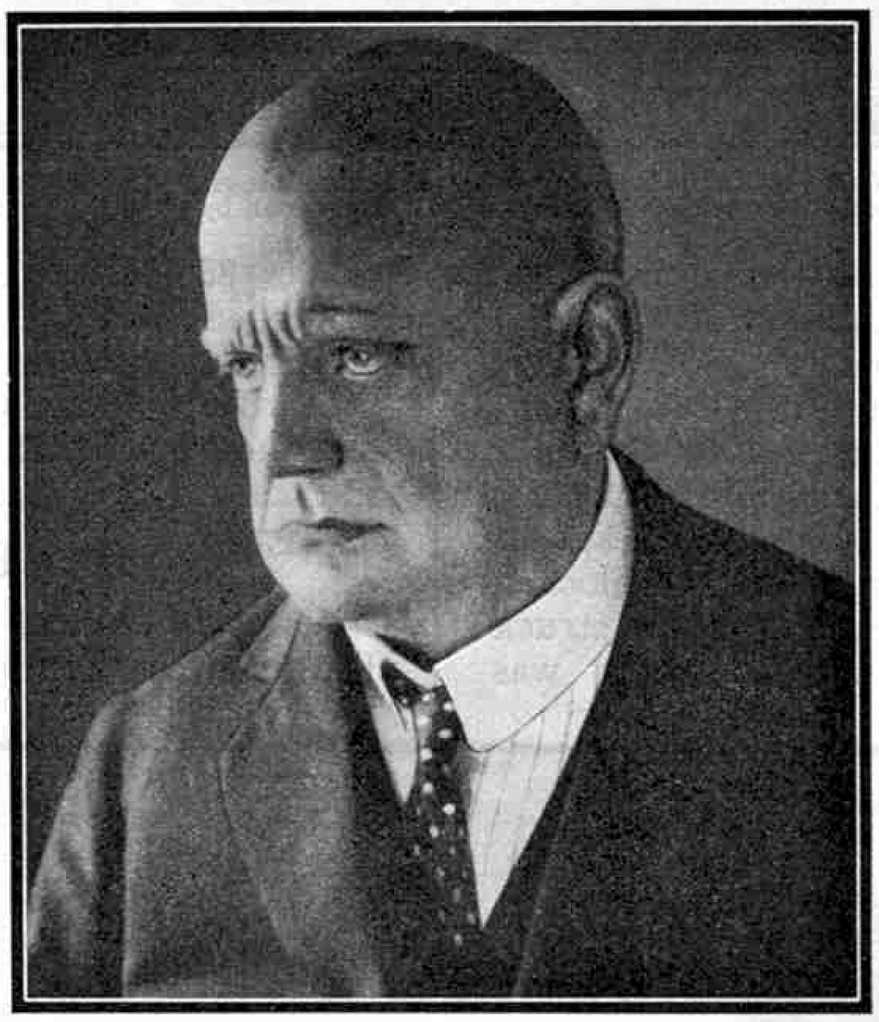
ONE of the greatest of living composers—perhaps the greatest—is Jean Sibelius. He is now in his 67th year, but it is only comparatively recently that his genius has come to be recognised outside his native country, Finland.

Sibelius has had the good fortune to receive since the year 1897 a regular State grant that has enabled him to devote himself to composition, and he has produced a steady stream of works of the highest quality. Some of this music, as for instance the "*Intermezzo*" and "*Alla Marcia*" from the "*Karelia*" suite, recorded on Columbia DX 307 (12 in., 4/–), makes an immediate appeal to every music lover; but much of it undoubtedly needs to be heard repeatedly before it can be really appreciated. At the same time there is a curious fascination about even the most difficult of Sibelius' music. After a first hearing we may conclude that the music does not appeal to us, or even that we dislike it; but in spite of ourselves we feel a desire to hear it again, and when this is possible we have taken the first step towards appreciation.

It is difficult to describe the music of Sibelius, for it is unlike that of any other composer, past or present. Perhaps its most characteristic features are its unflagging energy and its simple directness of purpose. When Sibelius has something to say he says it straight out without any preliminary fuss or explanation; and when he has said all he has to say he stops, sometimes quite abruptly. It is largely this directness that makes some of Sibelius' works sound rather forbidding on a first hearing. This impression soon wears off, however, and then the remarkable beauty of the music becomes evident. It is in many respects a strange beauty, suggestive of the moors, forests, lakes and islands of Finland, and of the wonderful legends that have grown up around them. These legends have always had a great fascination for Sibelius, and many of his finest works are definitely based upon them. The tone poem "*Finlandia*," for instance, is one of seven numbers written in connection with a series of tableaux illustrating scenes from Finnish mythology; and the symphonic poem "*Tapiola*," which is in many respects one of the composer's greatest works, is named from Tapio, a Finnish forest god. A more definite programme is followed in the symphonic poem "*Pohjola's Daughter*." This illustrates an episode from the Finnish saga "*Kalevala*," in which Pohjola, seated on a rainbow and busy at her spinning wheel, demands of a lover from the North that he should magically transform her spindle into a boat. This he fails to do and, seeing no hope of winning Pohjola, he departs in his sleigh.

The fact that the finest of Sibelius' music must be heard several times before it can be fully enjoyed and appreciated makes it particularly suitable for the gramophone. It is therefore interesting to note that a Sibelius Society has been formed, under the auspices of the Gramophone Co. Ltd., to make a series of gramophone records of the greatest of the composer's music. The records will be made by the finest interpretative artists of the day, and no effort will be spared to make them as perfect as possible. The first issue will consist of the symphonic poem "*Tapiola*" and one of the symphonies, probably the eighth, performed by the London Symphony Orchestra under Professor Robert Kajanus, a life-long friend of Sibelius. Provided that the required membership of 1,000 is forthcoming by 1st November, the records will be ready during that month. These records will not appear in the ordinary "H.M.V." catalogue.

There is no entrance fee, and the subscription for each series is £2/2/–, in return for which each subscriber will receive seven double-sided 12 in. "*His Master's Voice*" records in an artistic and durable album. A booklet containing interesting notes on the various works will accompany each set. Full particulars of the scheme may be obtained from any H.M.V. dealer.



A recent portrait of Jean Sibelius, the great Finnish composer. For our photograph we are indebted to the Gramophone Co. Ltd.

Records Worth Buying

A welcome orchestral record is that of two "*Elegiac Melodies*" by Grieg (Col. LX 168, 12 in. 6/–). These delightful pieces are splendidly played by the Concertgebouw Orchestra, conducted by Mengelberg, and are certain to appeal to all lovers of Grieg's music. Another attractive record is the "*Mignon*" overture by Thomas (Col. DX 355, 12 in. 4/–). This favourite overture is attractively performed by the Orchestre Symphonique, Paris, conducted by Eugene Bigot, and the recording is of first-rate quality.

Three Panachord orchestral records are well worth buying on account of their attractive subjects and excellent recording; at 2/6 these 12 in. discs are splendid value. The "*Intermezzo*" from "*Cavalleria Rusticana*" ought by rights to have been played to death by this time, but somehow it survives. It appears on the same disc (9005) as the "*Farandole*" by Bizet, and is well played by La Scala Theatre Orchestra, Milan. The same orchestra give a good rendering of Rossini's "*Barber of Seville*" overture (9007). The third Panachord record (9006) is the overture to "*The Beautiful Galathea*" which, like all Suppé's music, is brilliant and attractive, if not of outstanding quality.

An interesting Parlophone record (R 1229, 10 in. 2/6) is a selection from Offenbach's "*Bluebeard*," played by the State Opera Orchestra, Berlin. The music is attractive and the recording excellent. An Edison Bell record (5499, 10 in. 1/6) that should not be overlooked gives us a "*Waltz*" by Brahms, and Kreisler's popular "*Tambourin Chinois*," pleasantly played by Sylvia de Gay.

Among band records one of the best is a 12-in. Imperial (Z 127) containing two good marches, "*Kaiser Frederick*" and "*With Oak Leaves and Sword*," excellently played by the Imperial Military Band. Another good recording is that of the famous "*Washington Post*" with "*The Entry of the Boyards*" on the other side, splendidly played by the Black Diamonds Band (Zonophone 6146). Other good records are the "*Poet and Peasant*" overture, played by the Royal Horse Guards (Blues) Band on Sterno 972 (10 in. 1/3) and Tchaikowsky's "*Marche Slav*" on Sterno 8031 (12 in. 2/6), played by the Kneller Hall Band conducted by Capt. H. E. Adkins.

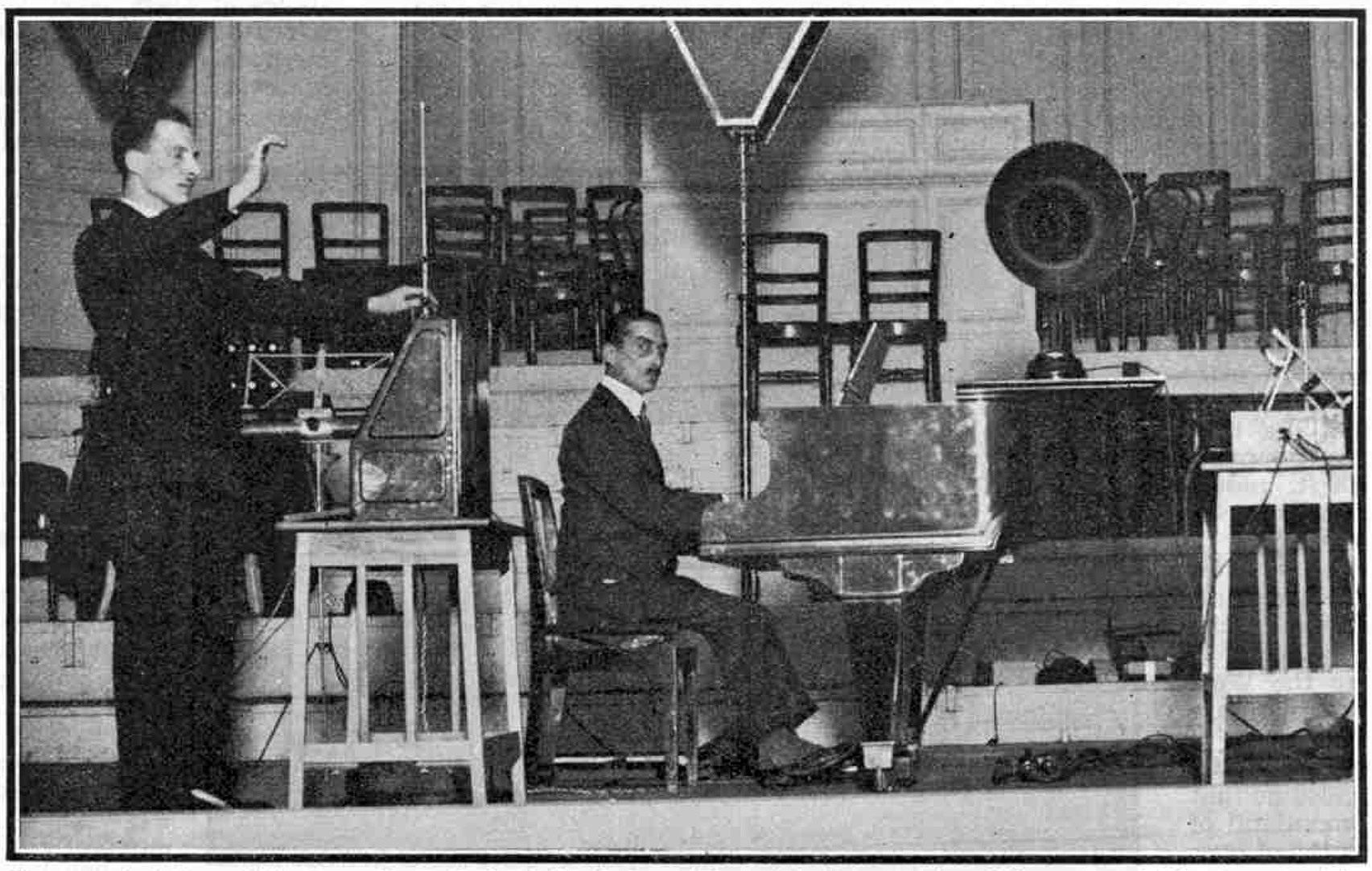
Among recent vocal records can be recommended Peter Dawson, bass baritone, in "*Give Me the Rolling Sea*" and "*There's Something at the Yardarm*" (H.M.V. B 4194, 10 in. 2/6), and Marcus Browning, bass, in splendid renderings of the negro spirituals "*Deep River*" and "*De Blin' Man Stood on de Road an' Cried*" (Edison Bell Winner 5500, 10 in. 1/6).

Music From The Ether

Loud-Speaker Howls Turned to Good Account

SOME time ago a great deal of interest was aroused by a series of concerts given in Europe and America by a Russian scientist, Professor Theremin, who produced the sounds of various orchestral instruments without any apparent mechanism. His apparatus was entirely electrical and was concealed in a " magic box," which was the object of a great deal of mystery to the general public until Professor Theremin described its operation.

The principle of the Professor's apparatus is easily understandable to anyone with a knowledge of wireless. The instrument is really a generator of electrical oscillations, and it turns to good effect phenomena that are a source of considerable annoyance to the radio experimenter, namely "hand capacity" effects, that result in howls and squealings in the loud speaker. Every reader who has operated a wireless set will know that when this is in its most sensitive condition a slight movement of the hand close to the tuning dial will result in a squeal or whistle in the loud speaker. This is due to the fact that the tuning circuit of the receiver has a certain electrical capacity to earth, and when the hand, or other part of the body, which may be considered as at earth potential, is brought close to the tuning dial, the capacity of the circuit is changed. Those who have heard the wide range of unwanted sounds that are produced in this manner will easily understand that if these oscillations could be controlled they would form intelligible musical sounds; and this is what Professor Theremin does in his apparatus.



The concert platform of the Opera House, Paris, during Professor Theremin's demonstration of his new musical instrument. The inventor is standing before his "magic box" at the left.

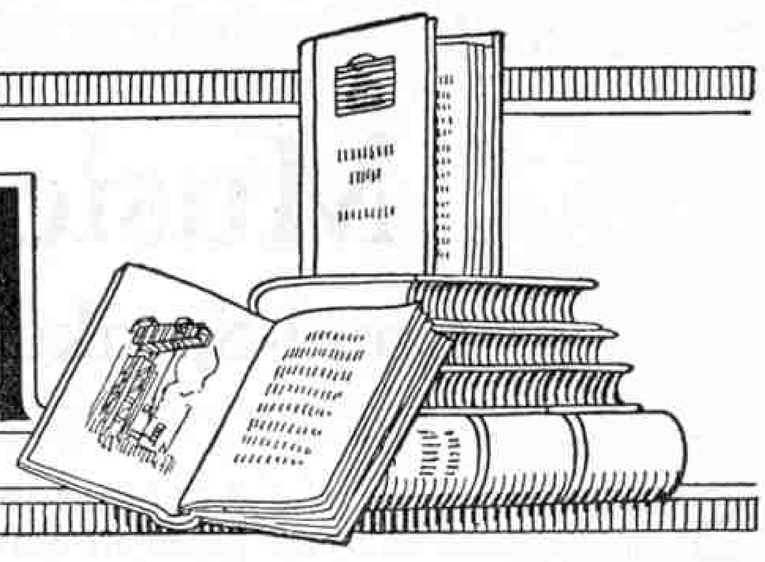
The instrument, which can be seen on the table on the left-hand side of the photograph, has a close resemblance to a radio receiver cabinet. On the top of the cabinet is mounted a long metal rod which is connected to a source of electrical oscillations very similar to the tuned or high-frequency circuit of a wireless receiver. The frequency of the oscillating circuit is determined by the capacity to earth of the vertical rod. When the hand is moved in the vicinity of the rod the capacity of the circuit is changed. The oscillating circuit is connected to a valve amplifier mounted in the cabinet, and this amplifier is in turn coupled to a system of loud speakers placed on the platform. Any movement of the hand in the vicinity of the vertical metal rod thus results in a change in the pitch of the musical sound reproduced in the loud speakers. In practice it is only necessary to move the hand through a distance of three or four ft. from the rod in order to reproduce the complete range of high and low notes.

On the left-hand side of the cabinet is a metal loop, the capacity of which may be altered by movements near it of the left hand of the performer. This is a volume control and the intensity of the sound produced may be varied from silence to full strength by making use of it. When maximum volume is required, the hand is raised to a distance of from 12 to 18 in. from the loop.

An ingenious device enables the characteristic tones of a piano, a violin or any other instrument to be reproduced. When a musical note is played, the sound waves of the fundamental frequency are accompanied by subsidiary vibrations. These are known as harmonics, and their frequencies are simple multiples or fractions of that of the fundamental vibration. The harmonics produced when a certain note is played on one instrument are different in character from those accompanying the same note played on a second instrument, and the differences largely account for variations in tone. In order to imitate the sound of any well-known instrument by means of Professor Theremin's apparatus, the oscillating circuit to which the vertical rod is secured is therefore adjusted to give suitable harmonics. These are reproduced by the loud speakers, the characteristic timbres of various musical instruments thus being reproduced without difficulty.

Professor Theremin's apparatus is extremely interesting but its practical value is doubtful.

Books to Read



Here we review books of interest and of use to readers of the "M.M." We can supply copies of these books to readers who cannot obtain them through the usual channels. Order from Book Dept., Meccano Limited, Old Swan, Liverpool, adding 1/– for postage to the price. Postages on different books vary, but any balance remaining will be refunded.

"Caving"

By E. A. Baker. (Chapman & Hall. 15/–)

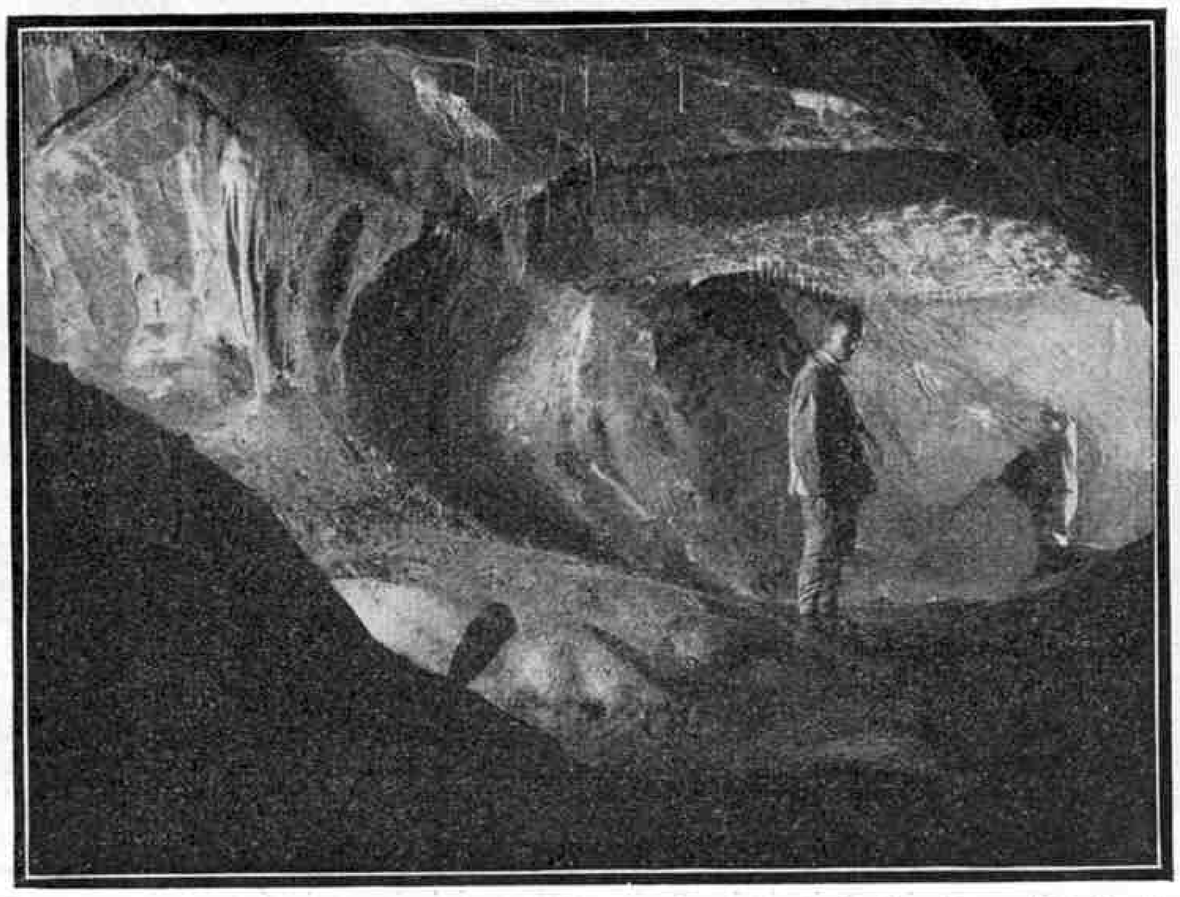
Dr. Baker gives us a lively account of his adventures during the last thirty years in exploring the caverns and pot-holes of Yorkshire, Derbyshire and Somerset. He tells us, too, of his activities in Ireland, and in the Cevennes, the Pyrennees, and other continental cave districts. There is also a novel chapter on underground exploration in and about London, dealing with dene holes, the Chislehurst Caves, and even the Fleet Sewer. Every type of cave scenery is illustrated with a striking series of cave photographs, depicting actual incidents of exploration.

The book is crammed with incidents, many of which are very exciting—especially that dealing with the imprisonment of a large party 400 ft. underground, by a flood above. There are many adventures in deep and mysterious water caverns, and the first exploration of the largest cave in the British Isles is described.

We learn that in the West Riding of Yorkshire there are some remarkable examples of "pot-holes"—vertical shafts in the mountain limestone that descend from the moorland of the Pennines to depths of over 300 ft. On the shoulders of Ingleborough, at a height of 1,300 ft. is a broad flat terrace of limestone, grooved and fluted by the action of water. In this district there are hundreds of pot-holes, into some of which streams are continually precipitating themselves. One of the largest of the pot-holes, Gaping Ghyll, drops 364 ft. sheer down into a chamber large enough to contain a cathedral. By means of a winch and wire rope explorers are lowered to the bottom in about 10 seconds, and are hoisted to the surface again in the same number of minutes. Down the pipe that leads from the surface to the chamber fall two large streams, so that oil-skins are necessary, as is also a helmet that is proof against falling stones. At the bottom of Gaping Ghyll and extending from the great chamber is a complex system of ancient passages, caverns, and pot-holes reaching to even deeper levels. These passages are believed to communicate with another great cave, but although the intervening region has often been explored in the attempt to find a through route, this has never been discovered.

In the Mendips there are many fine caves, one of the most extraordinary of which is Lamb's Lair, a subterranean labyrinth that has no natural opening to the surface. Here the largest stalactite chamber in Britain is to be seen in its incomparable beauty. "First discovered by miners in the 18th century it was lost for over 100 years, then found again and made accessible to the public in 1879. If the shaft is not repaired soon this cave bids fair to be lost again for ever."

The sport of cave exploring has been described as "mountaineering reversed," whilst M. Martell, a famous underground explorer, called it "sporting science," and that he aptly described it is evident from this very interesting book. We entirely agree with Dr. Baker when he says that we may regard caving as a healthy pastime, having certain important scientific aspects. Those who are interested cannot do better than read this well-illustrated and well-written book, which is lightened by occasional humour, especially in the chapters that deal with travel in Ireland and on the continent.



The final chamber in Mitchelstown Cave in Co. Tipperary, Ireland. From "Caving" reviewed on this page.

"Fishermen and Fishing Ways"

By F. P. Anson. (Harrap. 7/6)

The author of this book—the son of an Admiral and a descendant of a famous 18th century navigator—has been devoted to the sea and ships, and more particularly to fishermen and fishing craft, since he was a boy. He has shared in the adventurous life of the fishermen of several nations, and in addition to writing interestingly of his varied experiences has been able to collect much information bearing on the important part that superstition plays in the fisherman's life.

Mr. Anson not only has the gift of transferring his impressions to paper in words but he is also skilful with the brush, and he has illustrated his book with 150 line drawings. He rightly says "the history of fishing is bound up with the story of mankind, for from the very beginning, fishing has been one of the primary methods of obtaining food."

Probably early man caught fish by seizing them in his hands, or by throwing stones at them when they were reposing in some pool, or near the seashore. Such methods must date back to dim antiquity, however, for as early as the Palaeolithic Age (which ended about 10,000 B.C.) various kinds of primitive fishing gear were in use, including fish hooks made of flint, ivory, bone, and wood. The discovery of metal resulted in bronze fish hooks taking the place of the earlier ones of flint or bone. Bronze was followed by the iron hooks and spears of the Iron Age, and dating from this period have been discovered—in Switzerland—harpoons, floats, nets, and fishing boats, the last constructed out of hollowed-out tree trunks.

Continuing the story, we are told of the fishermen of ancient Egypt, Palestine, Greece and Rome. We learn that in Egypt fishing was an important industry and that there are many pictures of fishermen on the Egyptian tombs. There was an enormous development of the fisheries as early as 2,000 B.C., at which period the Egyptians were required to eat nothing but fish on the second day of the first month. Fish was one of the chief articles of food also in ancient Greece, and was held in even greater esteem as food in ancient Rome. Oysters were a particularly favourite dish among the Romans, and oyster beds were found in many parts of the Roman Empire.

After thus briefly reviewing the early history of fishing, we are given chapters on folk lore and superstitions; festivals and blessings of the sea; and fishermen and the law. The remaining chapters deal with different ways of fishing—trawler fishing, drift-net fishing, and line fishing. An interesting description of the cod fisheries follows and a final chapter on the capture of such creatures as pilchards, shrimps, lobsters and crabs.

We are sure that those who read this most interesting book will agree with the author when he says: "Fish folk all the world over are worthy of our infinite respect and admiration for, as Sir Walter Scott so truthfully expressed it 'It's no fish ye're buying. It's men's lives'."

"Opening Davy Jones's Locker"

By T. Williamson. (Harrap. 5/-)

This is the story of Ted Farnum, a boy scout, who explores the bottom of the sea and has thrilling adventures in the process. Ted accompanies two scientists on an expedition to the tropics and his adventures begin with the capture of a shark. This episode introduces him to the ceaseless struggle for existence that takes place beneath the surface of the ocean. Then follow many thrilling experiences, during which Ted descends in an observation chamber and begins a fascinating study of marine life. Later, he takes part in shallow diving, and has a great fight with a large fish of the shark species, being rescued only in the nick of time.

Of the submarine marvels with which he comes into contact, much could be written. There are fish of rainbow hue that change colour in harmony with their surroundings; fish that hunt only at night; "plants" that are really animals; and coral forests often so dense that they have to be "blown up" before observations can be continued. Sometimes at dusk the sea is lit up by masses of tiny creatures that give off a bluish light.

Ted helps the scientists to take photographs under the sea, and is so interested in the work that he makes up his mind to continue the investigations when he grows up. We hope he will soon be old enough to carry out his ambition, so that Mr. Williamson will be able to give us another volume describing his further adventures.

"Nature by Night"

By A. R. Thompson. (Ivor Nicholson & Watson. 12/6)

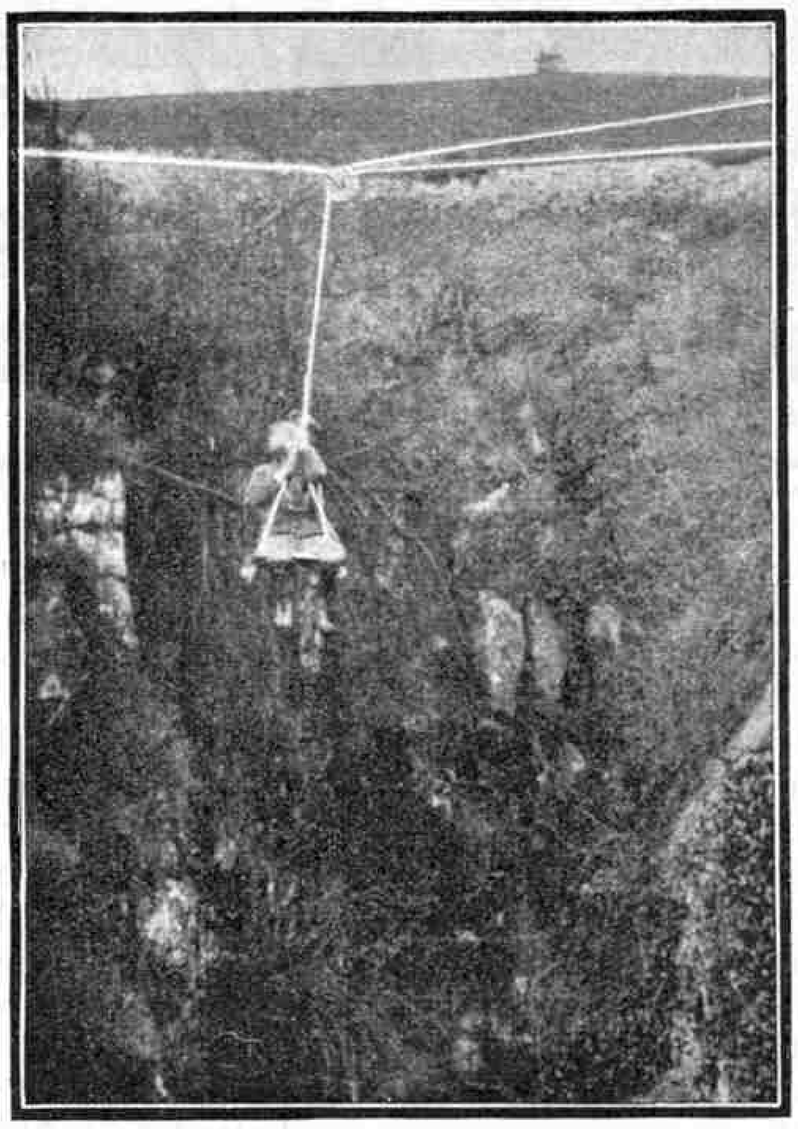
Anyone who has attempted to take nature photographs will be thrilled when he looks over the hundred photographs with which this book is illustrated. The book deals specially with the wild creatures of the British Isles that come out of their hiding places when night falls. For "life by night is everywhere, the hedgerows, fields and woodlands teem with it. The moors and sea shores are never silent. The night is a world of its own, a world apart from man who can never really enter it; can follow but only for a little way."

Mr. Thompson has succeeded in enabling us to follow some of the night life certainly a good deal more than "a little way." There are delightful chapters on the badger (an animal described in most books as being rare, but which in some districts actually is common); the fox and the otter; the stoat and the weasel. There are excellent photographs of, and descriptive matter regarding rats, mice and voles; hares, rabbits and squirrels; bats, and the insectivorous mammals; the hedgehog, mole, and the shrew; night birds; reptiles and amphibians. Finally, the moths and other nocturnal invertebrates receive the attention they merit.

The letterpress is nearly as interesting as the photographs, and is very helpful to the understanding of the ways of the night creatures. The author manages to include a great deal of interesting information in his 142 pages. Dipping at random, we learn that the glow-worm is inappropriately named, for it is a beetle and not a worm. An insignificant insect with a remarkable life history, the source of its light is still a puzzle even to our greatest scientists. The male has a couple of small spots of light at the end of his abdomen, but the female, a dark grey winged creature with six legs, has the power to produce an exquisite bottle-green light at the end of her body. The last three segments are illuminated and the light can be extinguished at will. Fabre has proved that the light is in some way due to oxidisation, for he ingeniously placed a glow-worm under water and found that the light still glowed; but when the water was boiled and so denuded of all oxygen, the light was immediately extinguished when the glowing female was immersed. The favourite food of the glow-worm is a small snail and you must read (on page 139) how these ingenious creatures anticipated man as the inventor of anæsthetics, and how they render snails unconscious before they proceed to devour them.

In the short space at our disposal it is difficult to do justice to this wonderful book and to the excellence of the illustrations and the quality of the printing. A copy should be in the possession of every nature lover and of every aspirant to animal photography.

The "Bee Hive" in Lamb's Lair in the Mendips. From "Caving" reviewed on the previous page.



Descending Elden Hole, a deep open pot-hole on the limestone hills, behind Castleton, Derbyshire. See previous page.

"English Seamen and the Colonization of America"

By E. Keble Chatterton (Arrowsmith. 12/6)

In this volume Mr. Chatterton, whose name is so well known in connection with the history of the sea and its ships, gives us a vivid picture of early seafaring days. He tells of the early voyages of discovery and exploration to America from 1492; and of the development and settlement in the New World that led to colonization and finally to independence.

He passes in review the story of America from the days when the imagination of the Old World was fired by the revelation of new lands beyond the sea. He shows us how the American nation really sprang from the sea, and emphasises the somewhat neglected fact that the early destiny of this great nation was guided inevitably by ships and sailors.

The narrative is one long drama of ships and exploration; plots and rebellions; and follies and fatalities. It is a story of human endeavour overcoming every conceivable kind of obstacle, until finally liberty triumphs.

Mr. Chatterton has succeeded in assembling many apparently insignificant details to make up the mosaic of a composite picture, and in doing so has shown us how in many cases just such insignificant details have resulted in big events.

The book is one that will certainly appeal to those of our older readers who are interested in historical narratives.

Interesting New Books

The undermentioned books, recently published, will be reviewed in a future issue.

The Case for the Sea-Serpent
by R. T. Gould. (Philip Allan, 7/6)

The Indian Ocean
by Stanley Rogers. (Harrap, 7/6)

Cycle Repairing and Adjusting
by Bernard Jones. (Cassell, 1/6)

Carburettors and Carburation
by A. W. Judge. (Chapman & Hall, 4/-)

The Seas
by Russell & Yonge. (Warne, 12/6)

Man's Microbic Enemies
by D. Stark Murray. (C. A. Watts, 7/-)

A Nature Calendar
by Eric Fitch Daglish. (J. Dent, 6/-)

The Motor Cyclist's Reference Year Book 1932-3 (Newnes, 1/-)

An Experiment in Industrial Organisation *by* E. Roll. (Longmans, Green, 15/-)

The Conquest of Space
by Davis Lasser. (Hurst & Blackett, 7/6)

Camp Fire Yarns and Stunts
by Vera Barclay. (Brown, Ferguson)

Birds of the Air
by A. W. Seaby. (A. & C. Black Ltd., 5/-)

History of Geographical Discovery and Exploration
by J. N. L. Baker. (Harrap, 12/6)

Exercises for Athletes
by Webster & Heys. (J. F. Shaw & Co. Ltd., 7/6)

Meccano Printing Machine

Constructional Details (Concluded)

THE previous articles dealing with the construction of the Meccano Printing Machine gave details of the general structural features of the model, and also of the construction of the platen and forme. This month the inking mechanism, pile feed and pile delivery will be described, of which movements the inking is the first consideration. Fig. 1 gives a good idea of the various inking rollers and their respective positions in the model.

In an actual printing machine the ink is smeared on the first of a series of rollers by means of a duct, or ink container, but in the model a movable roller is fitted that carries out the same duties, but for a somewhat shorter time. This roller is represented by a Wood Roller carried, at each end, on a Threaded Pin mounted on a $3\frac{1}{2}$" Strip. These two Strips are attached by Cranks to an 8" Rod that is journalled in the two end vertical girders of the frame. The Rod is mounted so that one of its ends protrudes for a distance of $1\frac{1}{2}$", and on this end is fitted a Crank 35 carrying a $2\frac{1}{2}$" Strip, in the end hole of which is mounted a $\frac{3}{8}$" Bolt engaging with a Threaded Pin on the frame of the model. When the $\frac{3}{8}$" Bolt engages the Threaded Pin, in the position shown, the Wood Roller is in a lowered position and is ready to receive its coating of printing ink. When the Crank 35 is lifted, and the $\frac{3}{8}$" Bolt in the end of the $2\frac{1}{2}$" Strip is rested on the flange of one of the main horizontal girders, the Wood Roller must lightly touch the $3\frac{1}{2}$" $\times 2\frac{1}{2}$" Flanged Plate 17 forming the inking slab, thus transferring the ink from the roller to the slab.

The ink on the slab is smoothed out, while the machine is in motion, by two $\frac{1}{2}$" diameter rollers each of which is 3" long. The core of these rollers is built up from Collars, Couplings and Washers, and the rubber covering consists of suitable lengths of rubber tubing of $\frac{1}{2}$" external diameter and $\frac{3}{8}$" internal diameter. This tubing is used on all the delivery and inking rollers used on the model, and it may be obtained from almost any hardware stores. The two rollers used for smoothing the ink are set so that they run in opposite directions diagonally across the inking slab, and sufficient side-play must be left at the ends of the Rods carrying the rollers.

A third roller 36, built in a similar manner to the diagonal rollers, is fitted, and this transfers the ink from the slab to the type face. This roller is held in contact with the type face by means of two Pendulum Connections, each of which is secured to a $\frac{1}{2}$" $\times$ $\frac{1}{2}$" Angle Bracket on the main frame by a 6BA Nut and Bolt. It should be remembered that printing ink hardens very quickly, and for this reason the rollers must be cleaned with paraffin oil at the end of each run, and then dried with a cloth.

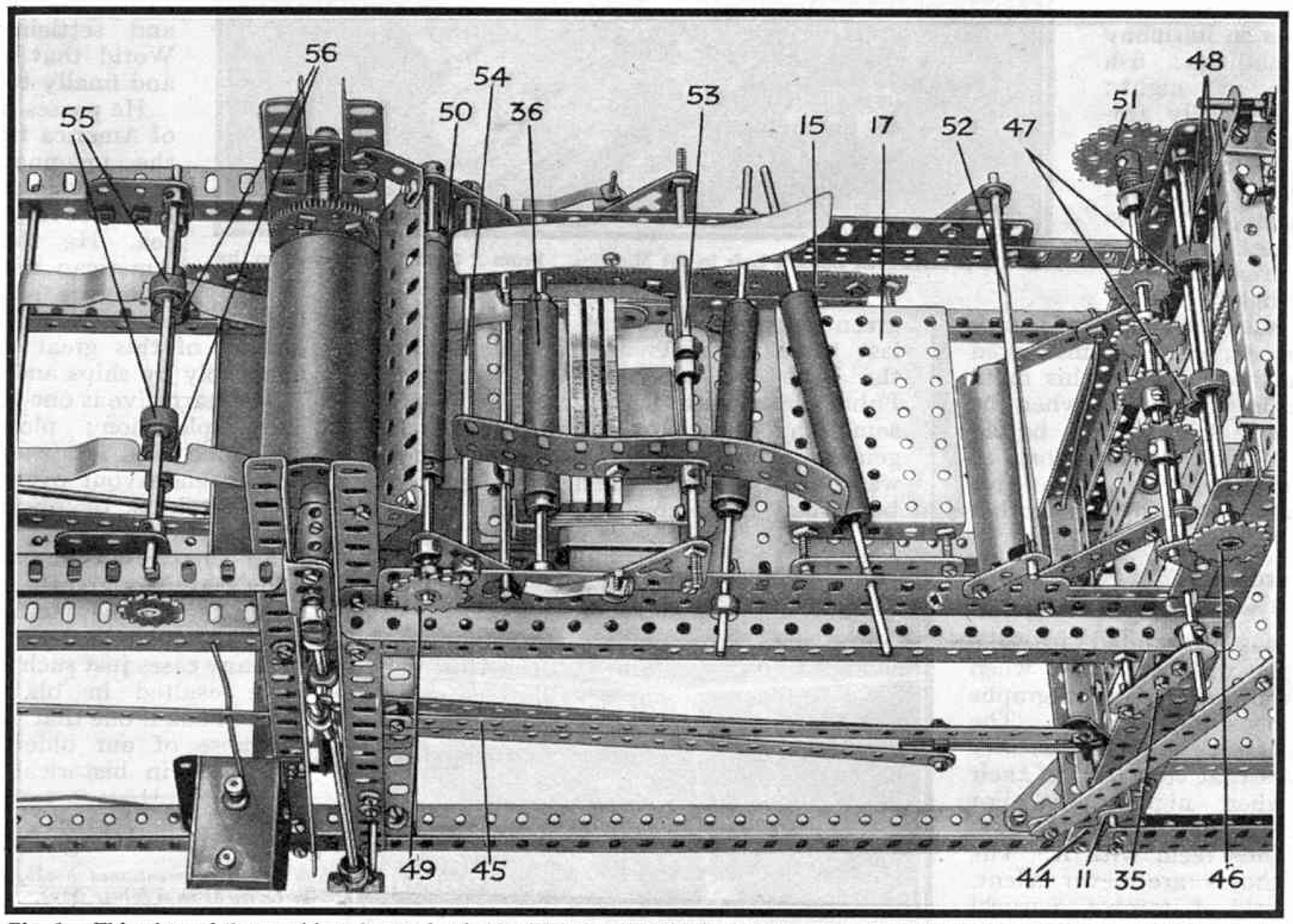


Fig. 1. This view of the machine shows clearly the inking and delivery rollers. The delivery chains have been omitted in order to show the arrangement more clearly.

The pile feed mechanism may now be built into the already constructed framework. A plan view of this section of the model is shown in Fig. 2, and from this it will be seen that the pile of paper is carried on a vertically sliding platform controlled by four chains loaded at their free ends and passing over $\frac{3}{4}$" Sprocket Wheels at the top of the frame. The chains are not shown in Fig. 2, but the arrangement will be seen from Fig. 1. The Sprocket Wheels over which the chains pass are slowly rotated by a gear train consisting of a 57-teeth Gear 37 that is operated by a Pawl pivotally mounted on a 2" Slotted Strip 38. This Slotted Strip is bolted to a 2" Strip, the two parts overlapping each other two holes. The 2" Strip is mounted on the vertical Rod carrying the Gear 37 and is rocked backward and forward by a Threaded Pin working in the slotted hole of the Strip 38. The Threaded Pin is secured by a Collar to an $11\frac{1}{2}$" Rod that is connected to the Coupling 21

(see Fig. 3 of last month's article) by means of two $9\frac{1}{2}''$ Strips. Thus, as the impression roller is actuated, the pile of paper to be fed into the machine is raised.

The paper, which is held between the four movable $11\frac{1}{2}''$ Rods 39, is lifted sheet by sheet by means of a Fan rotating at a high speed. The direction of rotation of this fan is so arranged that it causes a powerful suction immediately above the paper. The power for rotating the fan is derived from a 6-volt Electric Motor secured in place as shown in the illustration, and the drive is taken from a $1\frac{1}{2}''$ Sprocket Wheel on the armature shaft, by means of Sprocket Chain, to a second $1\frac{1}{2}''$ Sprocket Wheel 40. This latter Sprocket is carried on a 5" Rod, journalled in two $1''\times1''$ Angle Brackets, that carries a $\frac{3}{4}''$ Contrate meshing with a $\frac{1}{2}''$ Pinion on the fan shaft. The $1''\times1''$ Angle Brackets and the fan shaft bearing, a Double Arm Crank, are supported by doubled $5\frac{1}{2}''$ Strips that are bolted across the top of the feed framework as illustrated. It should be noted that each $1''\times1''$ Angle Bracket is spaced away from the doubled $5\frac{1}{2}''$ Strips by means of two Flat Brackets.

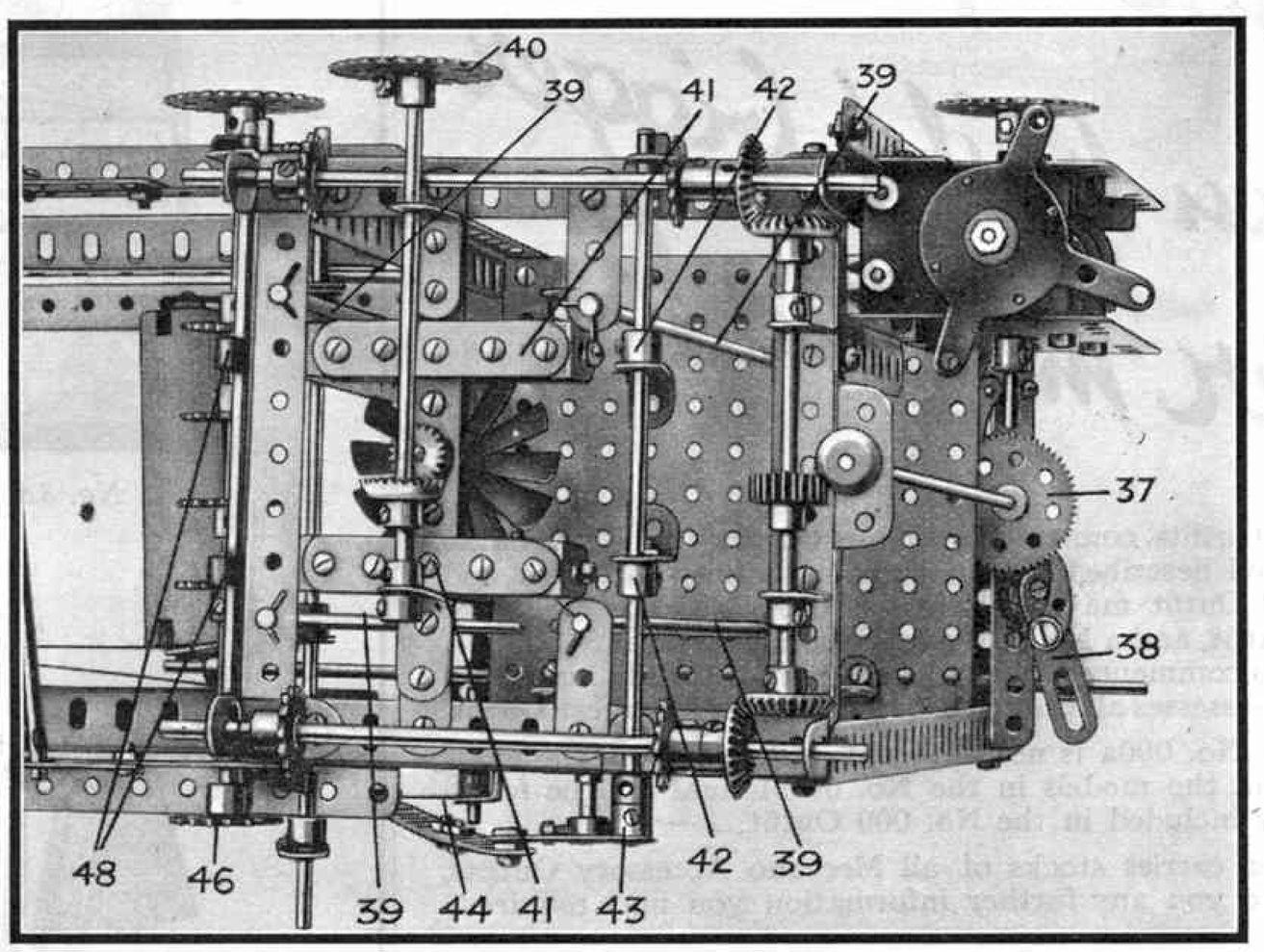


Fig. 2. A plan view of the suction feed mechanism showing the method adopted for raising the pile of unprinted paper.

In order to prevent the sheets of paper from becoming entangled with the fan, two projections 41 are fitted, each of which is built up from a $2\frac{1}{2}''$ Strip fitted at the ends with $1''\times1''$ Angle Brackets. The lower holes of these Angle Brackets support a $2\frac{1}{2}''\times\frac{1}{2}''$ Double Angle Strip.

Each pusher arm 42 is constructed from a Crank carried on a $6\frac{1}{2}''$ Rod and fitted with a Corner Angle Bracket at its lower hole. One pusher arm carries a right-hand Corner Angle Bracket and the other a left-hand part. The Rod carrying the arms is fitted at one end with a Crank 43, and this is attached by a pivotally-jointed connecting Rod to a second Crank 44. This Crank is carried on a $1\frac{1}{2}''$ Rod journalled in a hole of one of the main vertical girders and also in the Reversed Angle Bracket 11. This Rod is connected by a Crank and link 45 to the top of the lever 31 (see Fig. 2 of last month's article).

The belt feed mechanism and timing rollers are next fitted. The 1" Sprocket Wheel 46 is carried on the upper of the two Rods carrying the small rollers 47 and 48, and is driven by a length of Sprocket Chain from a second 1" Sprocket Wheel 49. This latter Sprocket is mounted on an 8" Rod carrying the lower of the two timing rollers, and also a $\frac{1}{2}''$ Pinion 50. This Pinion is rotated by a second similar Pinion that meshes with the rack 15, fitted to the side of the platen. The upper timing roller is similar to the lower roller, and both are carried in Corner Brackets fitted to each side of the frame of the model. Care must be taken to see that the lower timing roller does not touch the face of the type when the machine is in motion.

It will now be seen that, as the platen moves from the feed end of the machine towards the impression roller, the timing rollers rotate in a direction that enables a sheet of paper to be drawn in towards the impression roller, at the same moment as the platen commences its stroke. Thus, if the type is set in its correct position on the platen, the paper will have passed a short distance under the impression roller before the impression has commenced to be taken. While the timing rollers are rotating in this direction the rollers 47 and 48 are turning in an opposite direction. When the platen reaches the end of its first stroke, however, and commences the return stroke, the movement of the rollers is reversed, thus preventing any paper from passing the timing rollers but allowing the paper to pass through the rollers 47 and 48. At this point the pushers 42 are forced forward by the arm 31, thus pressing one edge of the next sheet of paper against the rollers, and in this manner immediately passing it forward on to four chains, the drive of which will be described later. These chains are shown in the general view of the model and they are

(Continued on page 726)

The parts required to build the Printing Machine are as follows:

4	of No.	1	2	of No.	9b	3	of No.	17	2	of No.	45	1	of No.	81	1	of No.	129
4	„ „	1a	2	„ „	9c	4	„ „	18a	1	„ „	46	20	ft. „	94	8	„ „	133
1	„ „	1b	2	„ „	9d	4	„ „	18b	1	„ „	48	3	„ „	95	6	„ „	136
7	„ „	2	3	„ „	9f	4	„ „	24	3	„ „	48a	1	„ „	95b	1	„ „	147
8	„ „	2a	8	„ „	10	1	„ „	25	1	„ „	48d	8	„ „	96	1	„ „	147a
4	„ „	3	1	„ „	11	5	„ „	26	4	„ „	52a	5	„ „	96a	1	„ „	157
8	„ „	4	18	„ „	12	6	„ „	27a	1	„ „	53	6	„ „	103	1	„ „	165
4	„ „	5	12	„ „	12a	2	„ „	27b	2	„ „	55a	4	„ „	103a	2	„ „	172
1	„ „	6	6	„ „	12b	1	„ „	29	63	„ „	59	1	„ „	103f	7	„ „	302
4	„ „	6a	8	„ „	13	4	„ „	30	14	„ „	62	2	„ „	103h	7	„ „	303
6	„ „	7	7	„ „	13a	1	„ „	31	2	„ „	62a	1	„ „	106	11	„ „	304
2	„ „	7a	13	„ „	14	1	„ „	32	4	„ „	62b	3	„ „	110	11	„ „	305
17	„ „	8	2	„ „	15	31	„ „	35	13	„ „	63	12	„ „	111	2	„ „	306
4	„ „	8a	2	„ „	15a	279	„ „	37	4	„ „	64	10	„ „	111c	2	„ „	308
6	„ „	8b	7	„ „	16	34	„ „	37a	1	„ „	70	9	„ „	115	1	No. 6 Electric Motor	
22	„ „	9	3	„ „	16a	200	„ „	38	2	„ „	72	4	„ „	116a			
2	„ „	9a	2	„ „	16b	2	„ „	43	3	„ „	77	1	„ „	125			

The following parts are not included in the No. 7 Outfit :—

1 E1 Electric Motor
1 Resistance Controller
17" of Rubber Tubing ($\frac{3}{8}''$ internal diameter).

With an Accessory Outfit you can build bigger + better models!

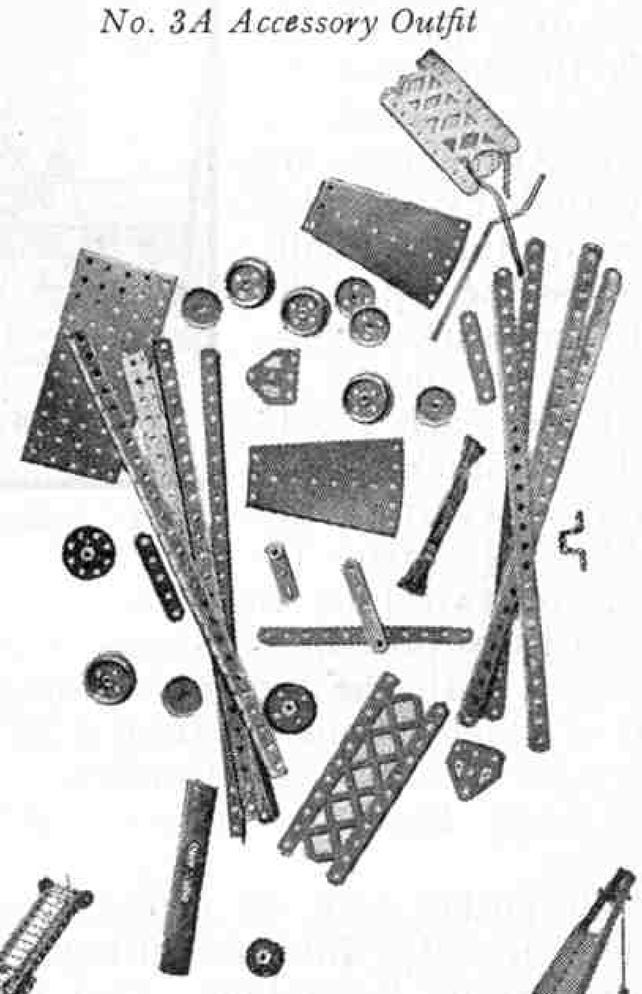
Meccano Accessory Outfits connect the main Outfits from No. 00 to No. 7. They may be well described as the stepping stones to bigger and better models. A No. 00 Outfit may be converted into a No. 0 by adding to it a No. 00a Accessory Outfit, and a No. 0a would then convert it into a No. 1. In this manner, a boy who commences with one of the small Outfits may build it up by degrees until he possesses all the parts contained in the largest Outfit.

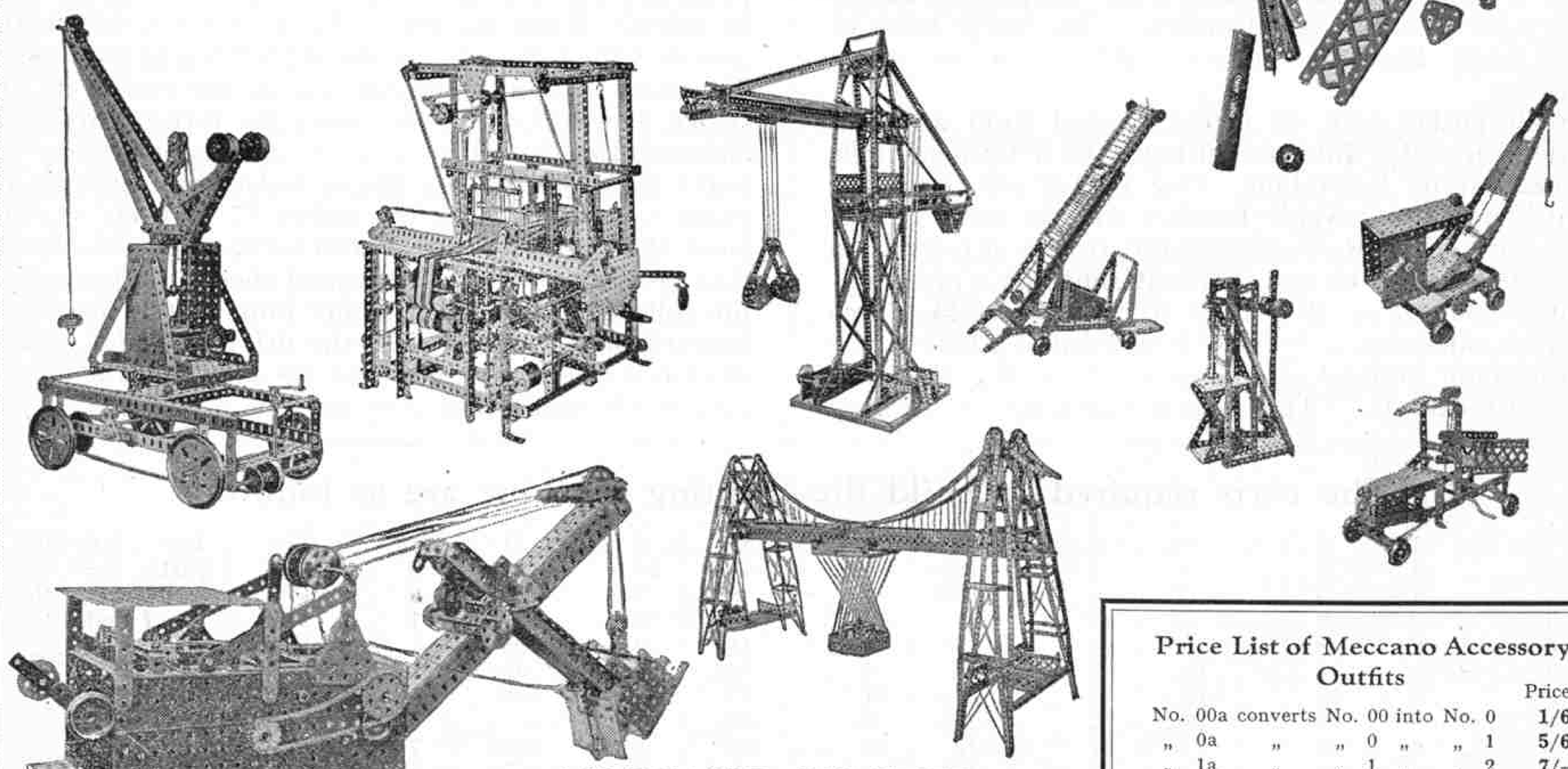
An Accessory Outfit No. 000a is not supplied, but details of the extra parts required to build all the models in the No. 00 Manual will be found in the Instruction Folder included in the No. 000 Outfit.

Your Meccano dealer carries stocks of all Meccano Accessory Outfits. He will be happy to give you any further information you may require.

MECCANO

No. 3A Accessory Outfit



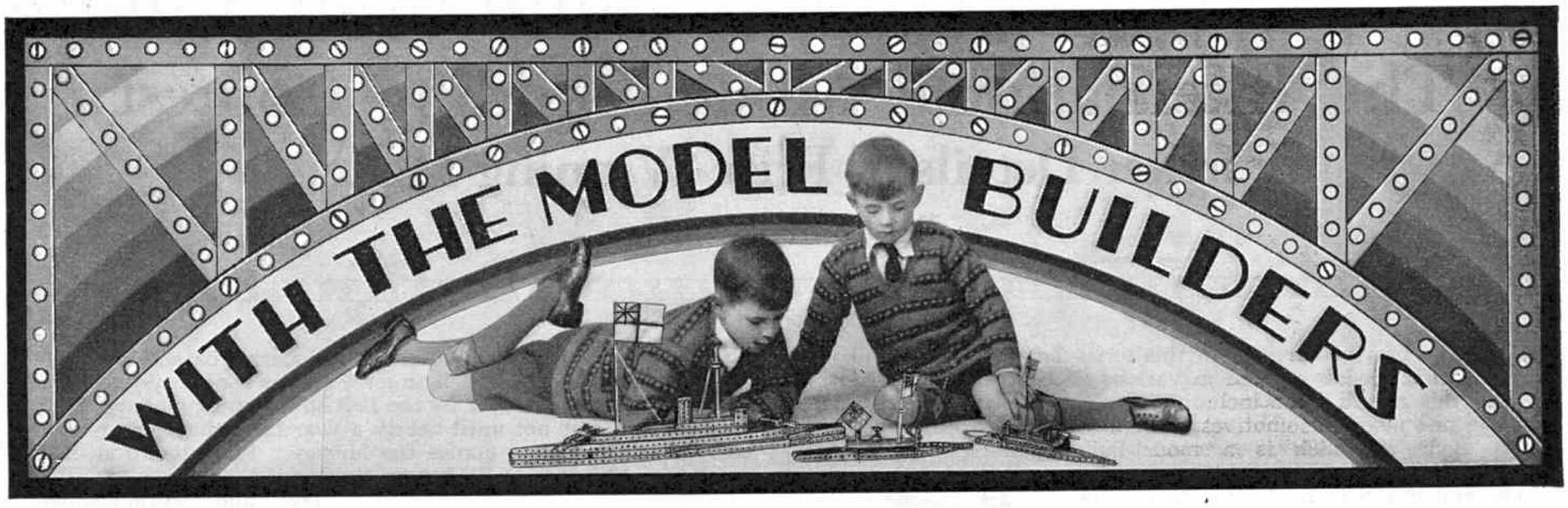


MECCANO LIMITED
OLD SWAN
LIVERPOOL

Price List of Meccano Accessory Outfits

							Price
No.	00a	converts	No. 00	into	No.	0	**1/6**
„	0a	„	„ 0	„	„	1	**5/6**
„	1a	„	„ 1	„	„	2	**7/–**
„	2a	„	„ 2	„	„	3	**12/6**
„	3a	„	„ 3	„	„	4	**26/–**
„	4a	„	„ 4	„	„	5	**17/6**
„	5a*	„	„ 5	„	„	6	**55/–**
„	6a†	„	„ 6	„	„	7	**235/–**

* Carton. † Enamelled Cabinet.



A NOVEL DESK MASCOT

There is a great deal of fun to be obtained from making mascots with Meccano parts, and on this page in the "*M.M.*" for April last we showed how two attractive cycle mascots could be built from Meccano Aeroplane parts. Interesting Meccano mascots can also be assembled for fitting to motor-cycles and cars. In Fig. 2 is shown a novel pattern of desk mascot that can be assembled quite easily from Meccano parts. The mascot incorporates one of the large Meccano die-cast Radial Engines (part No. P46), and is particularly suitable for use as a paperweight. The Radial Engine is supported on a Straight Centre Section Strut (part No. P29). A Nut is first of all screwed on to the threaded shank of the Engine and a Washer is slipped on to the shank. The Centre Section Strut is next placed in position on the shank and a second Washer fitted and followed by a second Nut. The second Nut is screwed up tightly, thus locking the Strut between the two Washers on the shank of the Radial Engine. A Bolt (part No. 537B) is then pushed through the hole in the right-angle lug of the Strut, and a large Identification Disc (part No. P101) is placed on the shank of the Bolt. The Bolt is passed through the central opening in a Wheel Flange (part No. 137) and a 1½" Strip is slipped on to the Bolt and held in position by means of a Nut. Before the 1½" Strip is placed in position it should be bent slightly at the centre, so that it acts as a spring and holds the Identification Disc rigidly against the outside surface of the Wheel Flange.

STEERING GEAR ASSEMBLY

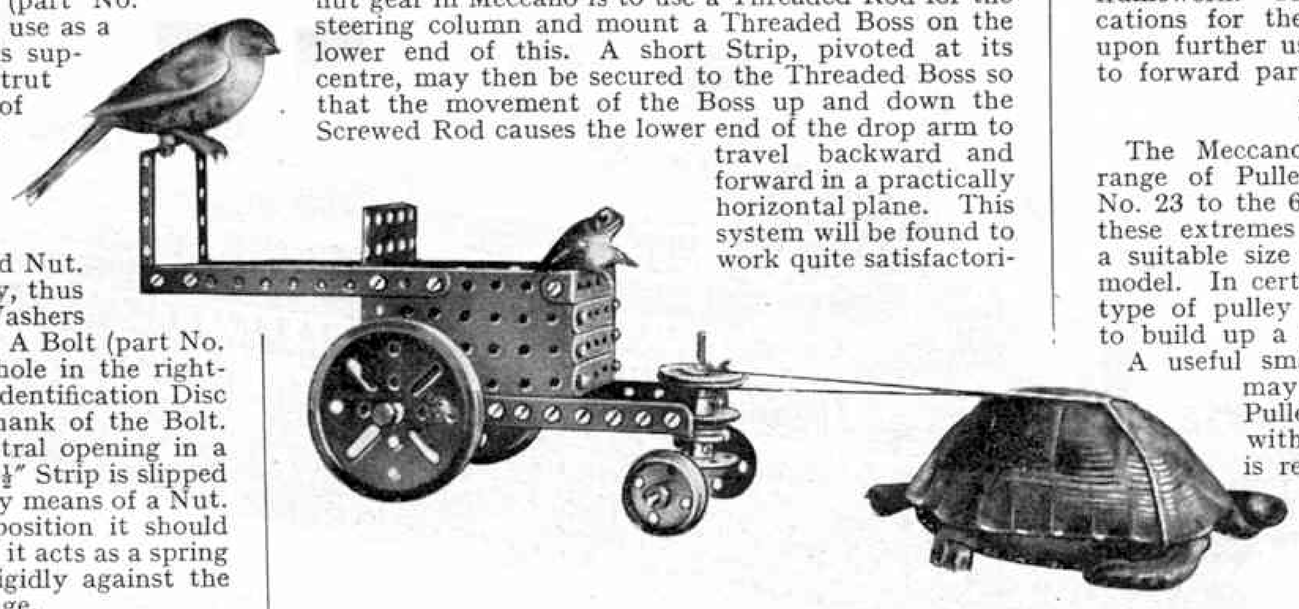
Although the Ackermann principle in the steering linkage of motor vehicles is now universal, several different types of gears are in use for transmitting the movement of the steering wheel to the stub axles. Of these the best known are the worm and wheel, the worm and nut, and the Marles patent cam gear.

The assembly of correct Ackermann gear will not present much difficulty to model-builders, as this gear is described fully in connection with the Meccano Chassis (see Instruction Leaflet No. 1). The assembly of correct pattern actuating gear is not quite so simple a matter, however, and a few notes on this subject will therefore be helpful.

The worm and wheel gear consists essentially of a fast-pitch worm mounted on the lower end of the steering column, and this worm engages with a Pinion Wheel mounted on a shaft journalled in the frame of the car. A lever known as the "drop arm" is keyed to the shaft carrying the pinion, and the drop arm in turn is pivoted on an arm known as the "drag link," which controls the wheels. When the steering wheel is rotated, the worm drives the pinion round and the arm moves backward and forward in an arc. The drag link is consequently actuated, and in turn operates the linkage connected to the front wheels. It is a simple matter to reproduce the worm and wheel gear in Meccano. The standard Meccano Worm (part No. 32) is secured on the end of the Axle Rod forming the steering column, and this is meshed with a ½" Pinion mounted on a short Rod journalled in the Chassis. A Crank is secured to this Rod to form the drop arm, while the drag link may be formed from a Rod fitted with a Collar, a Bolt being passed through the slotted hole in the Crank and screwed into the threaded bore of the Collar. The only disadvantage with this type of gear is that the ratio is rather high—when a ½" Pinion is used with the Worm the ratio is 19 : 1—and this means that the steering wheel must be rotated many times to achieve full "lock" in either a right or left-hand direction, which is of course contrary to actual practice. For this reason a Bevel Gear is sometimes found more suitable, as for example in the Meccano Chassis, as it is possible to obtain much lower ratios and the revolutions of the steering wheel are correspondingly reduced.

The worm and nut gear that is used by a large number of motor car manufacturers is rather more complicated. In this gear the worm mounted on the steering column works in a "nut" consisting of a block of metal having a threaded hole cut in its centre, the threads corresponding to the threads of the worm. A pivoted drop arm is secured to the nut, and the nut itself is prevented from rotating independently around the body of the steering worm. On rotating the steering column, therefore, the nut travels up and down the worm, and the pivoted drop arm is rocked backward and forward. This motion is then transmitted to the steering linkage through the usual drag link.

The simplest method of representing the worm and nut gear in Meccano is to use a Threaded Rod for the steering column and mount a Threaded Boss on the lower end of this. A short Strip, pivoted at its centre, may then be secured to the Threaded Boss so that the movement of the Boss up and down the Screwed Rod causes the lower end of the drop arm to travel backward and forward in a practically horizontal plane. This system will be found to work quite satisfactorily, but owing to the low pitch of the threads of the Screwed Rod the steering wheel must be rotated many times before any appreciable movement of the front wheels is obtained. This difficulty could of course be rectified by using a worm on the end of the steering column having a much faster thread. Some interesting experiments may be made by using a standard Worm (part No. 32) in conjunction with a "nut" formed from four 1½" Strips bolted together in rectangular shape, the drop arm being pivoted to this improvised nut by means of an Angle Bracket.



Solving the transport problem! A clever camera study showing how a pet canary and a toad enlisted the services of a friendly tortoise to draw their Meccano carriage.

The third actuating gear, Marles patent cam gear, is somewhat outside the scope of Meccano construction, as its operation is dependent on cams and other parts of special design. The systems of construction mentioned above will provide considerable scope for experiment, however, and should enable an efficient and realistic steering gear mechanism to be assembled.

NOVEL USES FOR THE WINDMILL SAILS

One of the great features of the Meccano system is the number of widely different uses that can be found for the majority of the parts. The Centre Fork, for instance, can be employed as a single toothed "striker" in a counting machine or as the knife in a knife edge bearing. The Bush Wheel may be used as a wheel centre or as a reinforced bearing for a Rod; the Hub Disc as the flange of a locomotive wheel or as a base piece, etc., etc. Often several uses are found for a part although at first it would appear that it could be applied for only one purpose. A particular instance of this is the Windmill Sail, part No. 61. This part has a number of small rectangular openings cut to represent the slats of an actual windmill sail. A line of standard Meccano perforations is also included, so that the sail may be bolted in position quite easily. Four of these Sails secured to a Bush Wheel or other part make an excellent wind unit for a model Windmill. They are also useful in the assembly of a very different form of power unit, an electric locomotive! The sails will be found very useful in models of this type as the rectangular openings give a good impression of the windows or "grilles" in the sides of the engine body.

Still another application of the Sails is in the assembly of the frames of small bogie trucks and travellers for model cranes, etc. The rectangular slots in this case do duty for the perforated girder frames of the bogies, etc., and enable a remarkably neat unit to be assembled. An interesting example of this application of the part will be found on page 18 of the "*Meccano Book of Prize Models.*"

Many model-builders use the standard parts in the assembly of model houses and similar structures, and here again the Sails will be found useful. Windows can be represented remarkably well by inserting one or more of the Windmill Sails in the openings in the framework. There are doubtless other useful applications for the Sails, and model-builders who hit upon further uses for this versatile part are invited to forward particulars.

BUILT-UP PULLEYS

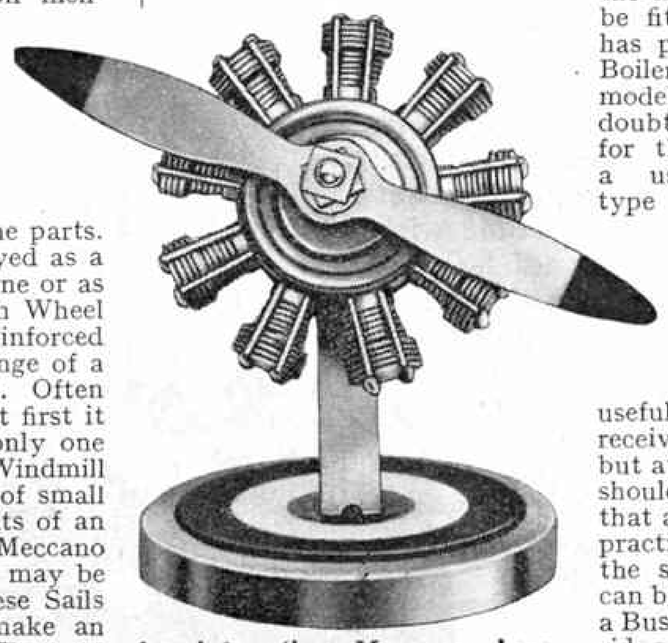
The Meccano system at present contains a big range of Pulley Wheels from the ½" Fast Pulley No. 23 to the 6" diameter pattern No. 19c. Between these extremes are 1", 1½", 2" and 3" Pulleys and a suitable size can generally be found for use in a model. In certain cases, however, a "deep groove" type of pulley is required and it is then necessary to build up a wheel from standard parts.

A useful small-size pulley assembly of this type may be made by clamping a ½" loose Pulley between two Bush Wheels mounted with their bosses outward. If a pulley is required with a slightly larger internal diameter a 1" loose Pulley may be clamped in between the Bush Wheels.

A useful deep-groove pulley for large models may be assembled from a 3" Pulley with a 4" Circular Plate bolted on each side. Deep-groove pulleys should be used whenever it is required to guide a long length of cord travelling at high speed. The deep groove prevents the cord from "jumping" the Pulley.

LOCKING WASHER. A split washer made from spring steel would be useful in locking nuts in models where there is considerable vibration. By using this Washer it would be possible to dispense with a second or "locking" nut, but there are very few instances in Meccano where it is impossible to use a second nut if required. We shall consider your suggestion, however. (*Reply to L. Gue, S. Edmonton, Alberta, Canada.*)

MODIFIED BOILER END. Your suggestion that the Boiler End should be fitted with a boss has possibilities. The Boiler End, as many model-builders have doubtless found out for themselves, forms a useful "dished" type of wheel for a heavy lorry, tractor, etc., and the addition of a boss on the inside surface of the part would be useful. This idea will receive consideration, but at the same time it should not be forgotten that a very speedy and practical conversion to the suggested pattern can be made by bolting a Bush Wheel to the inside surface of the existing Boiler End. (*Reply to P. Penty, Croydon.*)



An interesting Meccano Aero Mascot.

OLEO LEGS. Shock absorber or "oleo" units for fitting to aeroplane undercarriages would form interesting additions to the Aeroplane Constructor parts. This idea will be considered. *Reply to B. R. Weston Bristol.*)

The International Model-Building Contest

Further Details of Prize-Winning Models

By Frank Hornby

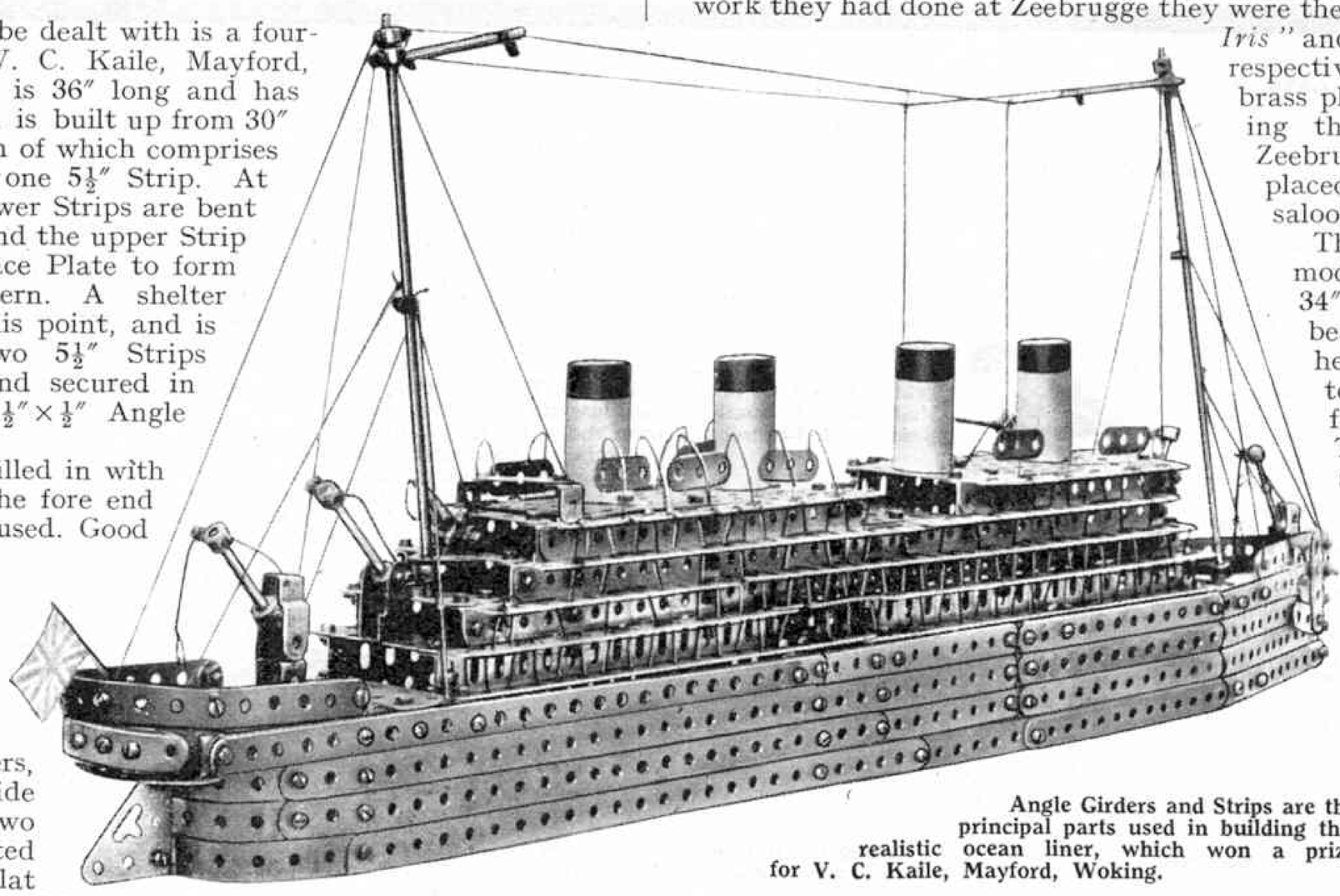
IN the two previous articles in this series I described a number of general models entered in various Sections of the Contest, and this month I am including illustrations and descriptions of some fine model locomotives and two widely different types of ships, each of which is a model-building masterpiece.

The first model to be dealt with is a four-funnelled liner, by V. C. Kaile, Mayford, Woking. The model is 36″ long and has five decks. The hull is built up from 30″ lengths of Strips, each of which comprises two 12½″ Strips and one 5½″ Strip. At the stern the three lower Strips are bent round a 1½″ Pulley, and the upper Strip is curved round a Face Plate to form the overhanging stern. A shelter rail is provided at this point, and is constructed from two 5½″ Strips moulded to shape and secured in place by means of ½″×½″ Angle Brackets.

The main deck is filled in with 12½″ Strips, and at the fore end 4½″ and 2½″ Strips are used. Good use is made of a Face Plate as a means of covering the difficult space in the stern. Each of the upper decks is represented by two lengths of Angle Girders, one secured to each side of the hull; and the two Girders are connected together by 2½″ Flat Girders and 2½″ Strips. All four decks are built up in this manner, and the outer flanges of the Girders carry long lengths of cord, threaded from one Girder to the next in the form of stitching, to represent deck stanchions.

I was pleased to see a number of miniature cranes attached to the model, three of which are near the stern and two near the fore hatch. Each crane is composed of a Rod attached to a Cranked Bent Strip by means of a Coupling, the Cranked Bent Strip being pivotally attached to the deck. Neat anchors are built up from 2″ Strips and 1½″ Strips, and the anchor chains are represented by lengths of Sprocket Chain. The inner ends of the Sprocket Chains are passed over capstans ingeniously constructed from the sleeve portions of Spring Buffers, the sleeves being carried on Threaded Pins secured to the forecastle deck by means of 1″×½″ Angle Brackets.

Anyone who is familiar with the actual ship will not fail to recognise the prototype of the fine model ferry boat shown on this page. It was built by W. Caton, Liverpool, and is a remarkably clever reproduction of one of the ships that carry passengers across the River Mersey, between the Wirral Peninsula and Liverpool. The actual vessel on which the model is based is the "*Daffodil*" which, together with her companion vessel "*Iris*," took part in the raid on the German submarine base at Zeebrugge. In 1917, after they had been on ferry service for many years, these two ships were taken over by the British Admiralty for special war work, and it was not until nearly a year later that they returned to resume their trips across the Mersey. In recognition of the work they had done at Zeebrugge they were then renamed "*Royal Iris*" and "*Royal Daffodil*" respectively, and engraved brass plates commemorating their share in the Zeebrugge raid were placed in their main saloons.



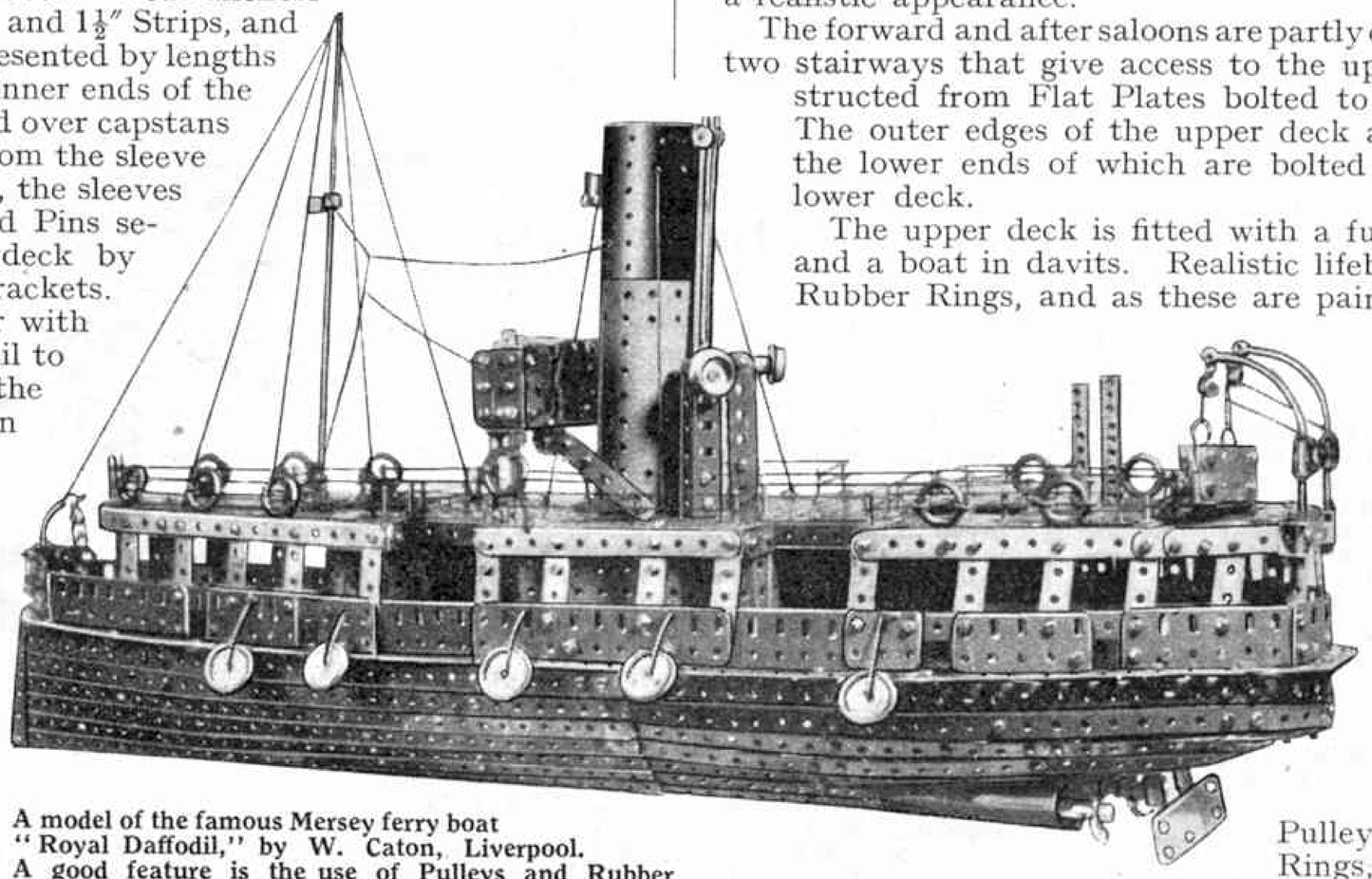
Angle Girders and Strips are the principal parts used in building this realistic ocean liner, which won a prize for V. C. Kaile, Mayford, Woking.

The fine Meccano model shown here is 34″ long and has a beam of 6½″, the height from the keel to the top of the funnel being 12½″. The keel is constructed from two 12½″ Strips bolted together at their ends, and to it are bolted 16 frames or ribs, eight of which are fitted to each side. The upper edges of the ribs carry ½″×½″ Angle Brackets to which the deck plates are bolted. The plating of the sides of the hull is carried out with Strips, bent at the stern to give the correct outline. The stern tubes each consist of three Sleeve Pieces joined together by a 4½″ Strip, and the end Sleeve Piece is capped with a ¾″ Flanged Wheel, in the boss of which the propeller shaft revolves. A touch of ingenuity is shown in the construction of the propellers, which are made from two Flat Brackets clamped on to the shaft by Collars, the blades being twisted slightly in order to give them a realistic appearance.

The forward and after saloons are partly cut away to accommodate two stairways that give access to the upper deck, which is constructed from Flat Plates bolted to the tops of the cabins. The outer edges of the upper deck are supported by Strips, the lower ends of which are bolted to the bulwarks of the lower deck.

The upper deck is fitted with a funnel, bridge, ventilators and a boat in davits. Realistic lifebelts are formed from 1″ Rubber Rings, and as these are painted white they enhance considerably the appearance of the boat.

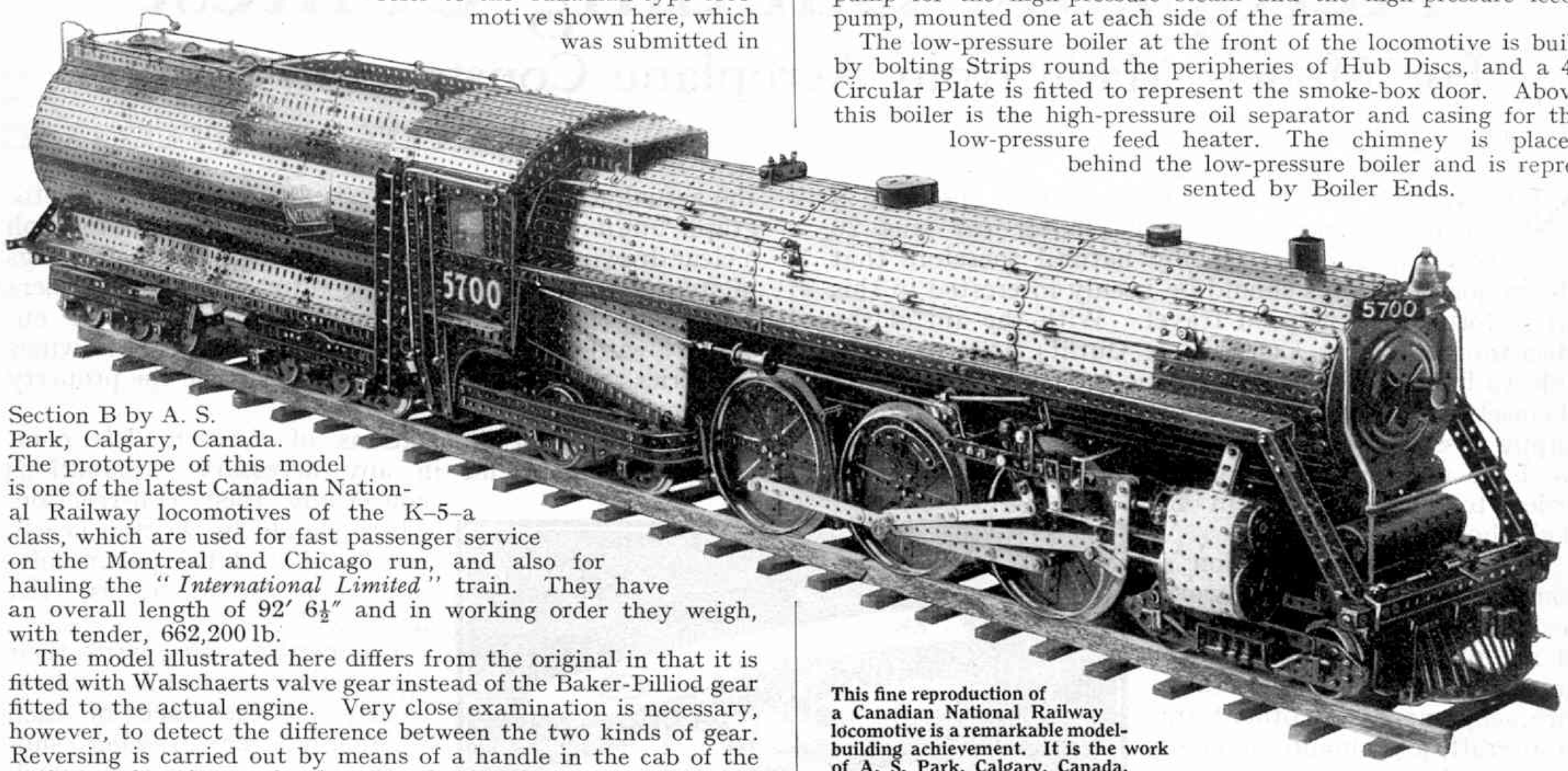
Owing to the continual shocks and strainings experienced by this type of vessel when mooring alongside a landing stage in rough weather, thick hemp fenders are hung over the sides of the lower deck. On the model these great pads are represented by 1″ Pulleys fitted with ⅝″ Rubber Rings, a little point that illustrates the builder's



A model of the famous Mersey ferry boat "Royal Daffodil," by W. Caton, Liverpool. A good feature is the use of Pulleys and Rubber Rings to represent the fenders hung over the ship's side.

familiarity with the more novel uses to which Meccano parts can be adapted.

I come now to what is probably one of the best models ever entered in a Meccano Competition. I refer to the Canadian-type locomotive shown here, which was submitted in Section B by A. S. Park, Calgary, Canada. The prototype of this model is one of the latest Canadian National Railway locomotives of the K–5–a class, which are used for fast passenger service on the Montreal and Chicago run, and also for hauling the "*International Limited*" train. They have an overall length of 92′ 6½″ and in working order they weigh, with tender, 662,200 lb.



This fine reproduction of a Canadian National Railway locomotive is a remarkable model-building achievement. It is the work of A. S. Park, Calgary, Canada.

The model illustrated here differs from the original in that it is fitted with Walschaerts valve gear instead of the Baker-Pilliod gear fitted to the actual engine. Very close examination is necessary, however, to detect the difference between the two kinds of gear. Reversing is carried out by means of a handle in the cab of the engine, and an interesting lever mechanism is fitted that enables the movements of the reversing link to be transmitted to the reversing lever of the 6-volt Electric Motor by means of which the model is driven. In this manner the valve gear is made to appear responsible for the reversing of the locomotive.

The boiler of the model is 7″ in diameter over its entire length, and its fittings include safety valves, steam dome, whistle, bell and headlamp. The front of the locomotive carries an air reservoir, a neat cow-catcher, and steps that give access to a platform running the length of the boiler.

The cab is a good representation of the short vestibule type usually fitted to these engines, and the boiler fittings include water and steam gauge, power reverse lever, injector control and a brake lever. Each axle of the bogies is sprung by means of spiral springs, and realistic axle boxes are fitted to each wheel. Dummy vacuum brake cylinders and track sprinklers give a realistic appearance to the tender, and it is also fitted with an automatic coupler, the action of which is similar to a spring jaw trap. The forward end of the almost circular tank is cut away in the form of a square well, which is used for carrying coal. An enclosing wall is fitted round the top of the well and a fine effect is obtained by the use of handrails.

Another masterpiece of model engine construction is shown in the lower half of this page. Although of a different type from the C.N.R. locomotive just described, this model ranks in the same high class of model-building, and represents a fine engine owned by the German State Railways. This is constructed on the Löffler system, the principle consisting of evaporating water by means of a jet of superheated steam in a non-fired boiler.

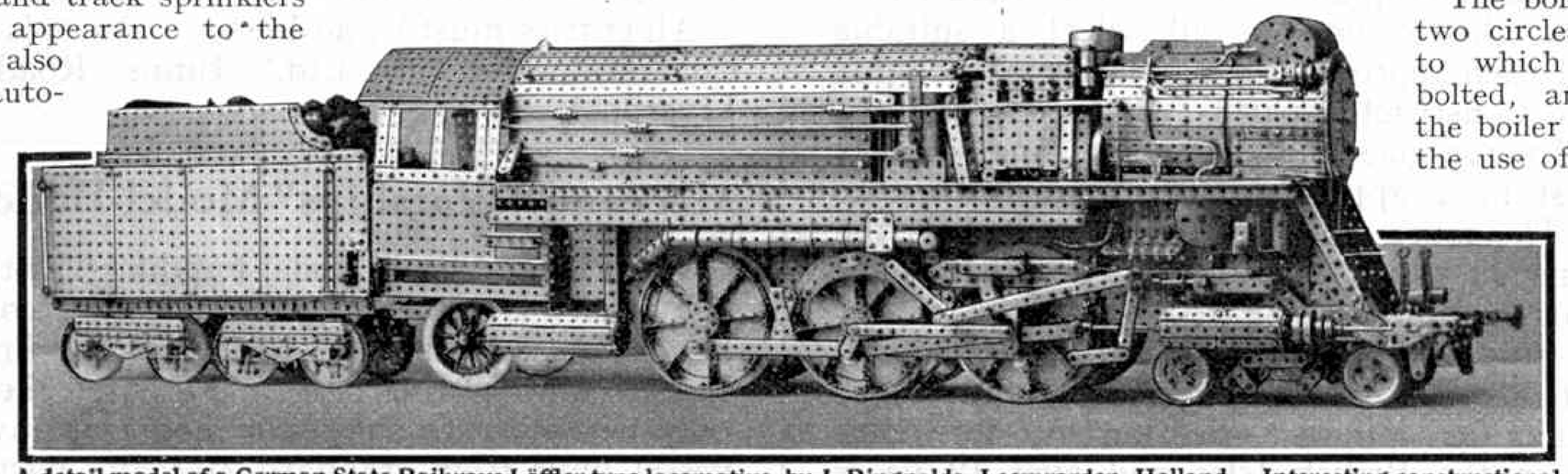
The model was built by J. Ringnalda, Leeuwarden, Holland, and was awarded a prize in Section A. The main frames are built from Angle Girders and Flat Plates, and the bearings for the axles of the driving wheels are supported on springs built up from a number of short Strips. The driving wheels consist of 6″ Circular Plates and Hub Discs, and spokes are added by securing Strips to the Hub Discs. The counter-balance weights on the centre pair of driving wheels are represented by 2½″ Curved Strips bolted to the spokes.

Flat Plates and Strips form the sides of the cab, the roof of which is built of Flat Plates. In front of the cab is the housing for the high and low-pressure superheaters, feed-heater and air pre-heater, and forward of this structure are the circulating pump for the high-pressure steam and the high-pressure feed-pump, mounted one at each side of the frame.

The low-pressure boiler at the front of the locomotive is built by bolting Strips round the peripheries of Hub Discs, and a 4″ Circular Plate is fitted to represent the smoke-box door. Above this boiler is the high-pressure oil separator and casing for the low-pressure feed heater. The chimney is placed behind the low-pressure boiler and is represented by Boiler Ends.

In striking contrast to the giant modern locomotives I have described is a small yet beautifully built model of "Puffing Billy," which was built by William Hedley in 1813 and was one of the earliest steam locomotives. Unfortunately I am not able to illustrate this model.

The main frame is built of Angle Girders, and at the rear a Clockwork Motor is fitted between them. A Pinion is secured on the lower end of the Motor driving spindle, and meshes with a Contrate Wheel on a horizontal Axle Rod, which also carries a Pinion. This Pinion engages another Contrate on a Rod placed across the frame between the driving wheels, and on this Rod are two Couplings that transmit movement to the overhead beams, which in turn operate the piston rods, valve rods and the water pump. The drive to the front wheels is conveyed from the centre axle through 57-teeth Gears.



A detail model of a German State Railways Löffler type locomotive, by J. Ringnalda, Leeuwarden, Holland. Interesting constructional items are to be seen in every part of this beautiful example of Meccano model-building.

The boiler is made from two circles of short Strips to which 5½″ Strips are bolted, and the back of the boiler is finished off by the use of carefully curved Strips secured to a Bush Wheel. At the front of the boiler the chimney is fitted. The cylinders, which are attached to the side of the boiler, are made up of Double Angle Strips bolted to Bush Wheels.

The water barrel is built up from short Strips curved to the correct shape, and these are attached by means of Angle Brackets to Face Plates forming the ends of the barrel. A weighted lever type safety valve is mounted on the boiler.

Although I have endeavoured to describe all the most interesting features of these fine models, space does not permit me to give the minor details that are necessary to enable constructors to build the models for themselves, and in view of this I would like to remind readers that all the best models in the International Model-building Contest, including those illustrated in these pages, are contained in the 1932 "*Book of Prize Models*," which is now on sale. This fine book contains descriptions and illustrations of a hundred wonderful models, and as many details as possible are given for building them.

Every keen constructor should possess a copy of the "*Book of Prize Models*" for it will go a long way towards helping him to build bigger and better models.

Aeroplane Building Contest

For Models Made from Aeroplane Constructor Outfits

NOWADAYS aeroplanes are almost as popular a means of transport as the motor car was 20 years ago, and it is only natural therefore that the majority of boys should be keenly interested in this latest form of high-speed travel. With the aid of the Meccano Aeroplane Constructor Outfits boys are now able to build all kinds of realistic model aeroplanes for themselves, and as there are already many thousands of happy possessors of these new Outfits all over the world, we have decided to organise a special competition, in order to encourage them in their hobby.

To enter the Competition a competitor should set to work to build a model of any type of aeroplane. The model may be a monoplane, biplane, autogiro, seaplane, or any other form of aircraft, and should be based on a real aeroplane of well-known make. *It must be constructed entirely from Meccano Aeroplane Constructor parts; ordinary Meccano parts must not be used.* Each model must be built entirely by the competitor without assistance from anyone. If desired two or more models may be entered, but no competitor will be awarded more than one prize.

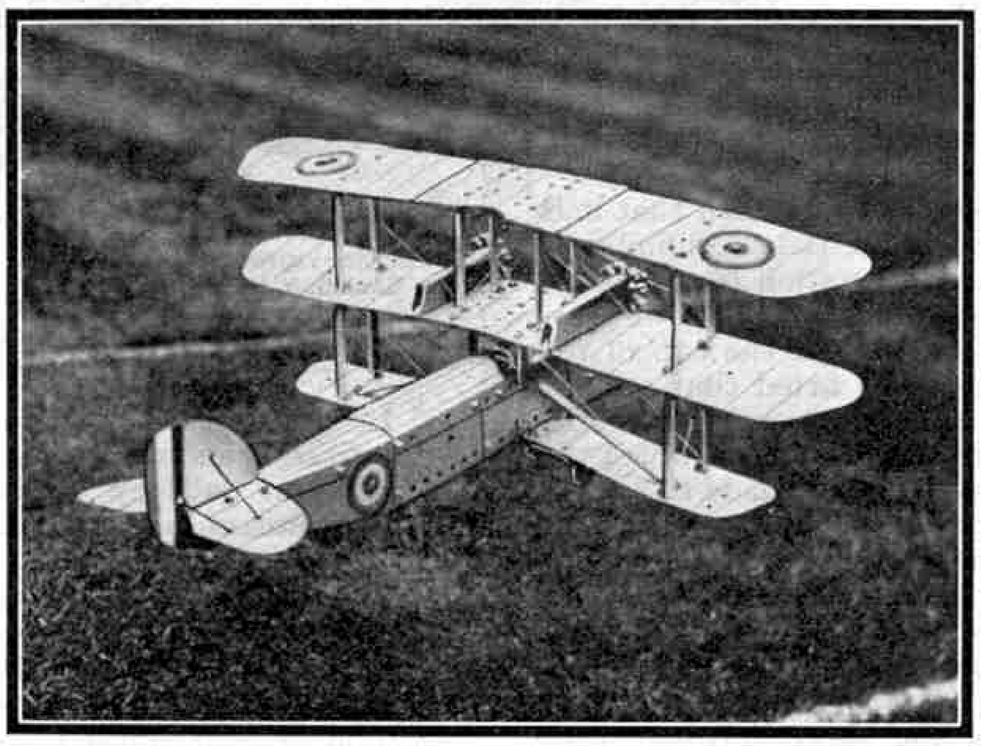
Competitors must not, of course, copy the models illustrated in the Aeroplane Constructor Instruction Manuals. They should first of all select a suitable prototype, and then reproduce it as closely as possible with Aeroplane Constructor parts. Hundreds of illustrations of real aeroplanes that will make fine subjects for this Contest have appeared from time to time in the "*M.M.*" The more closely a model resembles the actual aeroplane on which it is based, the greater will be its chance of winning a prize.

In order to give every competitor an equal chance, irrespective of his age, the Contest is divided into different sections as follows:—Section A, for competitors living in the British Isles and over 12 years of age; Section B, for those living in the British Isles and under 12 years; Section C, for competitors living Overseas. Although entries from Overseas competitors will be grouped into one Section, the age of each contributor will be taken into consideration when judging the models.

In each Section a separate set of prizes will be given for the most neatly assembled and original models received. Details of the prizes appear in the panel on this page.

Competitors must not send the actual aeroplane. The best plan is to send a photograph, but if it is not possible to obtain a good photograph a clear drawing will do as well. Photographs or drawings of unsuccessful models will be returned to the senders providing that a stamped addressed envelope is enclosed with the entry. Photographs or drawings of entries that win prizes, however, become the property of Meccano Ltd.

In addition to illustrations of their models competitors should send in any necessary explanations concerning their construction. These should be written neatly on one side of the paper only, and they should be as brief as possible.



A Triplane built from Meccano Aeroplane Parts, by J. Brandwood, Birkdale.

Competitors must write their age, name and full address clearly on the back of each photograph or drawing submitted. An entry from which this information is missing will be automatically disqualified.

As many boys who will wish to take part in this Competition may be away on holiday when this announcement is published, the Contest will remain open for a period of two months. The closing date for Sections A and B is 31st October, 1932. Overseas competitors must forward their entries so as to reach this office on or before 31st December, 1932.

All entries must be addressed "Aeroplane Constructor Contest," Meccano Ltd., Binns Road, Old Swan, Liverpool.

The Prizes

The Prizes to be awarded in Sections A and C are as follows:—

First Prize: Meccano or Aeroplane Constructor parts value £3-3s.
Second Prize: Meccano or Aeroplane Constructor parts value £2-2s.
Third Prize: Meccano or Aeroplane Constructor parts value £1-1s.
Six Prizes of Aeroplane Constructor parts value 7/6.
Six Prizes of Aeroplane Constructor parts value 5/-.

The Prizes to be awarded in Section B are as follows:—

First Prize: Meccano or Aeroplane Constructor parts value £2-2s.
Second Prize: Meccano or Aeroplane Constructor parts value £1-1s.
Third Prize: Meccano or Aeroplane Constructor parts value 10/6.
Six Prizes of Aeroplane Constructor parts value 5/-.
Six Prizes of "Famous Trains" by Cecil J. Allen.

The principal prize-winners in each Section will also be presented with a specially designed Certificate in two colours, to form a permanent record of their success in the Contest.

Meccano "Warships" Model-Building Contest

The "Warships" Model-building Contest announced last month is still open, and intending competitors who have not yet entered should do so immediately, as time is now getting short. To enter the Contest it is only necessary to submit a model of any type of war vessel built from standard Meccano parts. Models of subjects other than war vessels are not eligible for entry.

Competitors should send either photographs or drawings of their models, and should take care to write their age, name and full address on the back of each sheet of paper used. Full details of the Contest, and the list of prizes to be awarded, appeared in the August issue of the "*M.M.*" The Home Sections close for entries on 30th September, 1932, and the Overseas Section on 30th November, 1932.

Model-Building Contests Results

By Frank Hornby

"Actual Machines" Competition

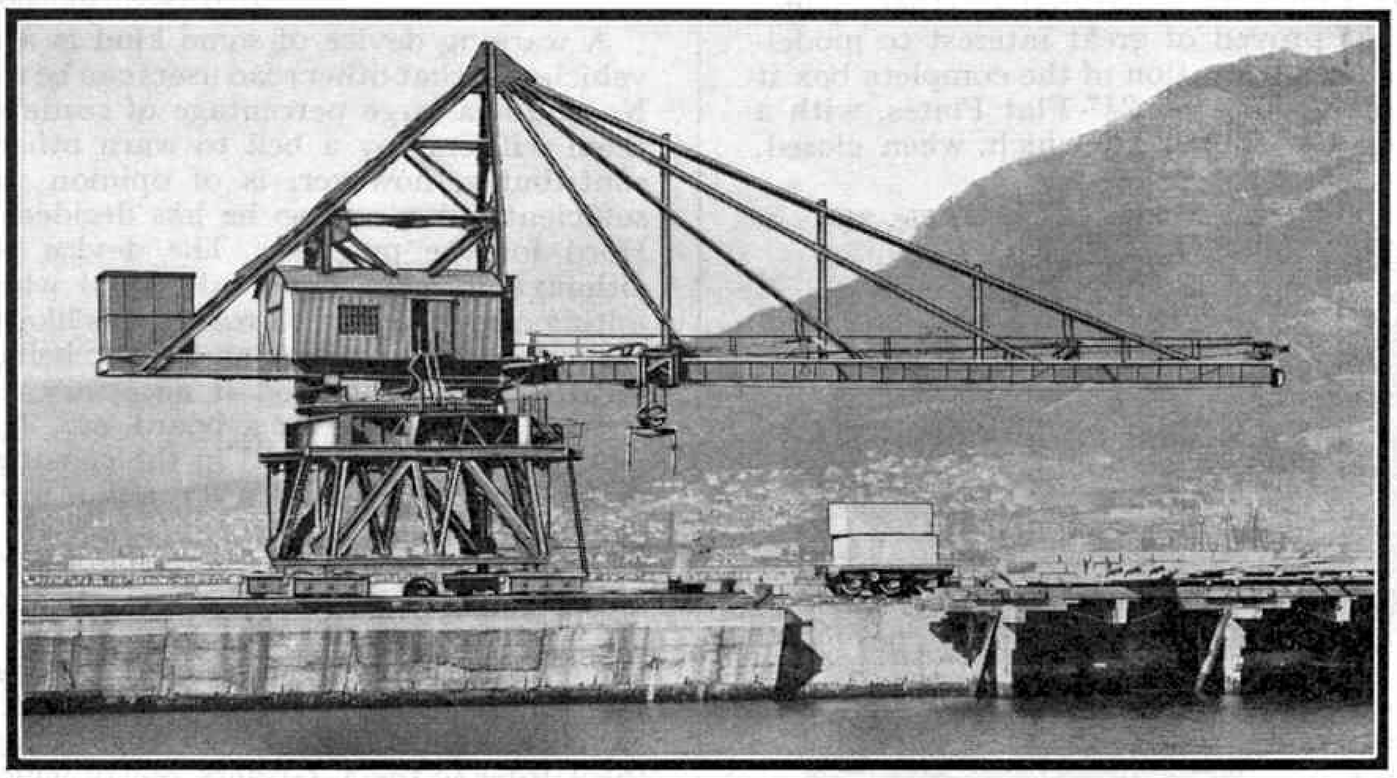
THE "Actual Machines" Competition was organised in connection with the article entitled "The Henderson Cable Drag-Scraper," which appeared in the December 1931 issue of the "*M.M.*"

Competitors were asked to build models of any definite make of machine, and each model submitted had to be accompanied by an illustration of the actual machine it represented. Models that were not based on any definite original were not eligible for this Competition. A surprisingly large entry was received, and the quality of the work was very fine indeed.

The prizes were awarded as follows :—

FIRST PRIZE, Cheque for £2-2s. : John H. Sheldon, Smethwick, Staffs. SECOND PRIZE, Cheque for £1-1s. : K. W. Cameron, Claughton, Cheshire. THIRD PRIZE, Cheque for 10/6 (to be divided between two competitors), R. Alington and G. Alington, Invercargill, N.Z.

CERTIFICATES OF MERIT : G. Somerwill, Southampton ; V. Kaile, Mayford, Nr. Woking ; T. Dunning, Huddersfield ; L. Willis, London, W.2.

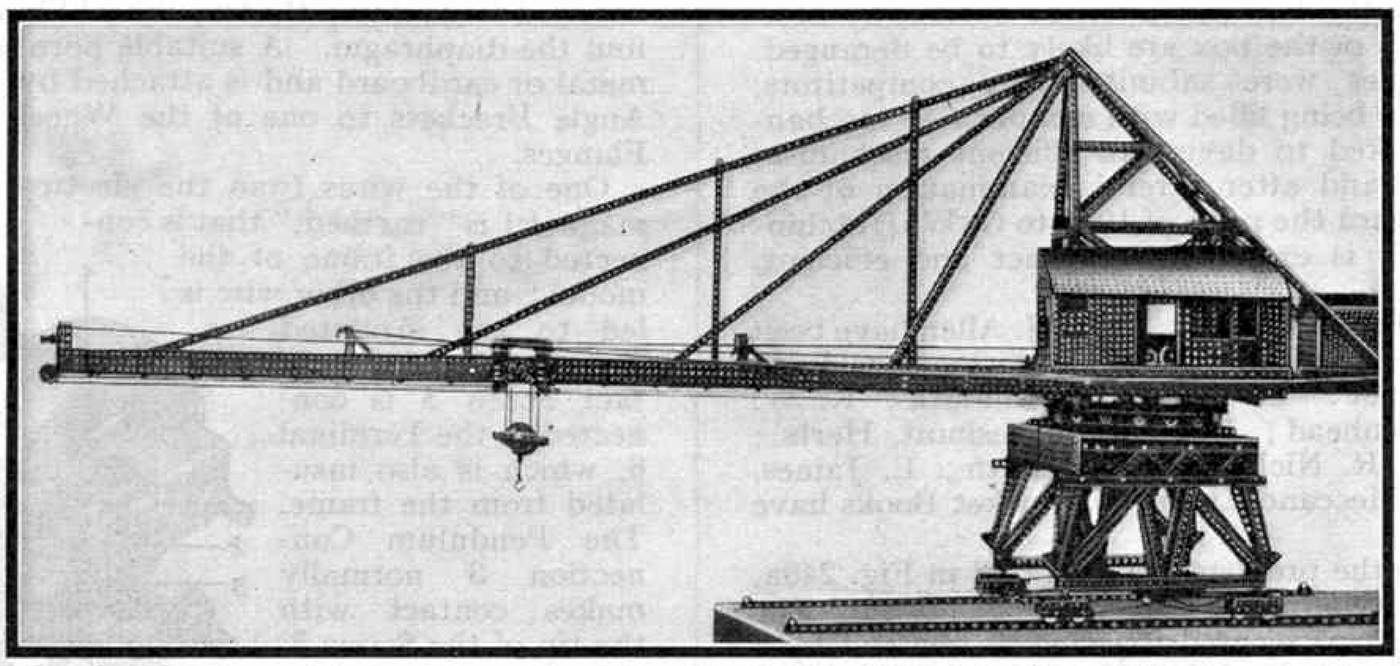


This long reach Titan Blocksetting Crane is the prototype of the fine Meccano model shown below. It was built by Stothert & Pitt Ltd., Bath, for use at Table Bay, Capetown, S.A.

To be successful in this Contest a model had to incorporate all the main features of the mechanism, external appearance and operation of the actual machine on which it was based. This is a task not always easy of accomplishment, even to an experienced constructor ; but in the long reach blocksetting crane illustrated here, not only all the main characteristics, but also many of the minor features of the actual machine have been copied very closely. The model was built by J. H. Sheldon, and a few moments' study of the illustrations will reveal the fine qualities that placed it at the head of the prize list.

The model is of rather unusual design and proportions and is based on a "Titan" crane built by Stothert & Pitt Ltd., Bath, for the South African Railways and Harbour Board, for blocksetting work in Table Bay.

The crane travels on four bogies, each of which consists of 3½″ Flat Girders joined by 1½″ × ½″ Double Angle Strips and 1½″ Angle Girders. Each bogie is provided with two Flanged Wheels, two 50-teeth Gear Wheels meshing with a ¾″ Pinion, and a ¾″ Sprocket Wheel on the Rod of the road wheels. Angle Girders are bolted across the top of each side of the gantry, and support the lower disc of a Roller Bearing on which the superstructure revolves. The drive to the bogies is taken from the mechanism in the superstructure by a vertical Rod that passes through the centre hole of the Roller Bearing. From this Rod Sprocket Chains transmit the drive to the ¾″ Sprocket of the bogies.



J. H. Sheldon, Smethwick, Staffs., won First Prize with this splendid model. It is a faithful reproduction of the actual crane and is described in this page.

The model is driven by a 6-volt Electric Motor. A ½″ Pinion secured to its armature spindle turns a 57-teeth Gear Wheel on a 2″ Rod journalled in the side plates of the Motor, and a ½″ Pinion on this Rod engages the teeth of a similar gear wheel on a 2½″ Axle Rod. This Rod, which is in constant rotation, carries two 1″ Gear Wheels with their faces placed together to form a 1″ × ½″ Gear Wheel, and this transmits the power to an 8″ Rod that slides in the sides of the gear-box and has four definite positions. In the first position it causes the trolley to travel along the boom, and when moved to its second place drives the hoisting drum. In its third position it causes the superstructure to rotate, and in its fourth the 1″ Gear engages the gears that drive the model along the rails. The movements of the Rod are controlled by a handle placed at the front of the driver's cabin. In the actual crane Fidler's patent blocksetting gear may be used in place of the loaded hook.

While some models attract attention by their massiveness and intricate mechanism, others force their way into notice by their beautifully neat and simple construction. It was a model of this latter type that won Second Prize for K. W. Cameron. It is a reproduction of a Howard "S" type 3-ton petrol locomotive, and in appearance it resembles the Kerr-Stuart Diesel locomotive that was illustrated in the January 1929 issue of the "*M.M.*" The Howard engine is petrol-driven, however, and has a large cooling radiator and engine bonnet at the front. The model is built on the unit principle, the chassis, engine unit, and cab each being complete in itself. All the internal and external features of a Howard engine are carefully copied in the model, which appears to be exceptionally sturdy and capable of withstanding considerable strain.

Two brothers, R. H. and G. W. Alington, tied for Third Prize, which was therefore divided between them. R. H. Alington sent a model of a Leyland "Tiger" omnibus, which he was fortunate enough to be able to copy from a real 'bus that he saw being constructed. The model has four speeds forward and reverse gear, and is sprung on four semi-elliptic springs. It is also fitted with Ackermann steering and four-wheel brakes.

G. W. Alington submitted a model of a Leyland "Hippo" six-wheeled motor lorry. An Electric Motor, clutch and gear-box form the power unit, which is separate from the chassis. The propeller shaft, which has two universal joints, transmits the Motor drive to two differentials, one on each rear axle, through a ½″ Pinion and a 1½″ Contrate. The drive to the rearmost axle is taken through a ½″ Pinion that engages the 1½″ Contrate on the forward axle.

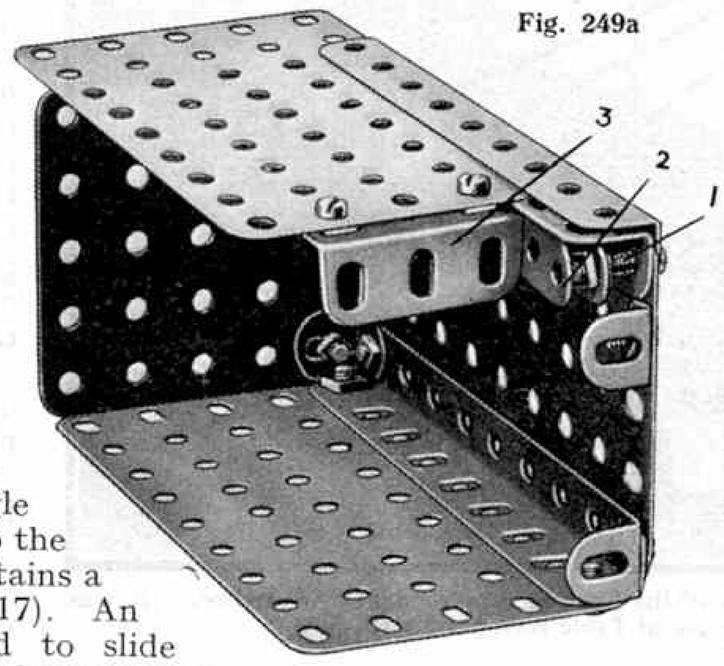
Suggestions Section "Spanner" Edited by

The ideas printed in the "Suggestions Section" should prove a real help to thousands of Meccano enthusiasts. Often we receive letters from readers who describe how they have solved some knotty problem or evolved an interesting model after studying some of the ideas that have appeared. We shall always be pleased to receive further contributions for the "Suggestions Section." Cash payments are made for all Suggestions published (excluding those mentioned in the "Miscellaneous" Suggestions column). Contributions should be accompanied by clear photographs or drawings and should be addressed to "Spanner," c/o The "Meccano Magazine."

Results of Puzzle Box Contest

The Meccano Puzzle Box that was illustrated on these pages under Suggestion No. 249 has proved of great interest to model-builders. If readers refer to the illustration of the complete box it will be seen that this is built up of $4\frac{1}{2}'' \times 2\frac{1}{2}''$ Flat Plates, with a Plate of similar size forming the sliding lid which, when closed, cannot be re-opened unless the catch is released.

Fig. 249a



The puzzle lies in finding the catch. W. J. Langstaff (Boston, Lincs.), who originally submitted details of the box, uses a very ingenious mechanism to operate which the box has to be turned upside-down. A small rectangular box-like structure, built up from Angle Brackets, is attached to the side of the box and contains a Steel Ball (part No. 117). An Axle Rod is arranged to slide through the Brackets forming the lower half of the structure, and is secured to the lid of the box. When this is closed the Steel Ball occupies the lower half of its receptacle, and as soon as an attempt is made to open the lid, the end of the sliding Rod strikes the Ball. When the box is inverted the Steel Ball drops out of place and no longer prevents movement of the Rod, which is free to slide, thus allowing the lid to be opened. This mechanism is well thought out, but it has the disadvantages that the box can often be opened by accident, and that the contents of the box are likely to be deranged.

Many interesting schemes were submitted by competitors, in some cases the entire box being filled with complicated mechanism! Competitors were asked to devise an efficient mechanism combined with simplicity, and after careful examination of the entries it was decided to award the prize of 10/6 to G. W. Hutchinson (Abergele), whose lock is extremely compact and efficient, yet simple in operation.

Six prizes of a copy of "*Famous Trains*" by C. J. Allen have been awarded to the following competitors, whose ideas were considered to be of outstanding interest:—D. Caddy, Portsmouth; K. W. Cameron, Claughton, Birkenhead; B. Gentle, Cheshunt, Herts.; S. Desai, Navsari, India; R. Nicholas, Portsmouth; L. James, Cinderford. A number of Meccano Engineer's Pocket Books have also been awarded.

Hutchinson's solution to the problem is illustrated in Fig. 249a, which shows the box with two of the Flat Plates removed. The catch consists of two $4\frac{1}{2}''$ Strips secured together at one end by a Bolt passed through the corner hole of the $4\frac{1}{2}'' \times 2\frac{1}{2}''$ side Plate. The Strips are bent outward slightly and a further Bolt holds them together at the centre, but a Washer on the Bolt shank is placed between the two Strips. The inner Strip carries the $\frac{1}{2}''$ Bolt 1, which is slidable in the side Plate, but the Bolt should not protrude beyond the Strip 2 that forms the catch. When the lid is slid forward to close, the $1\frac{1}{2}''$ Angle Girder 3 forces the catch back and it springs into position again immediately the lid is closed. The Girder is spaced from the lid by Nuts on the shanks of the securing Bolts, thus allowing the lid to slide freely. Careful examination of the box is necessary to enable it to be opened if the solution is not known, and if the box is lined with paper, so that the mechanism cannot be observed, the difficulty of the task is increased.

(265) Electric Horn

(J. Windsor, Birmingham)

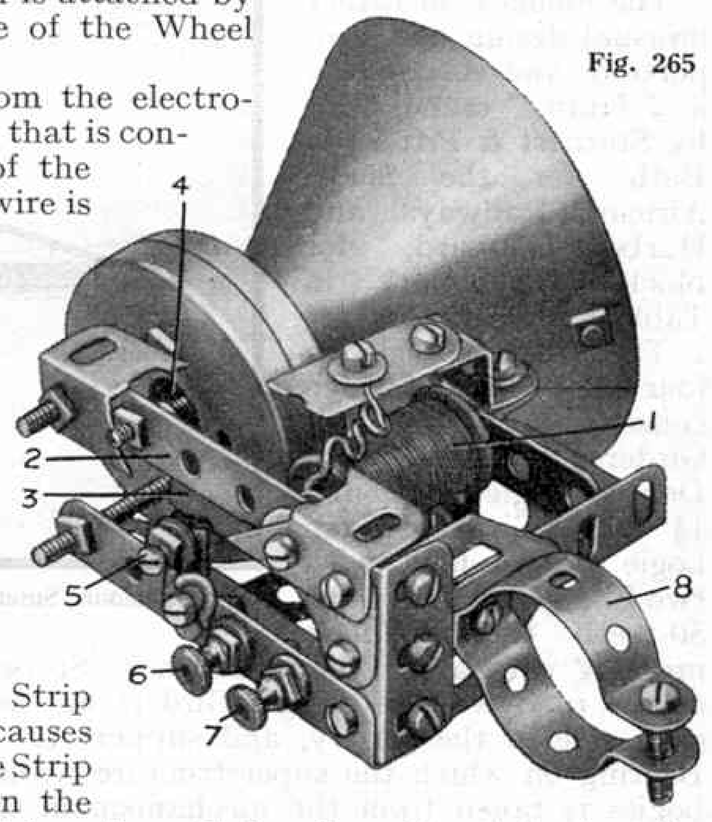
A warning device of some kind is a necessary accessory for all vehicles, so that other road users can be made aware of their presence. No doubt a large percentage of readers are cyclists, and most of them will employ a bell to warn others of their approach. Our contributor, however, is of opinion that a bell does not make sufficient noise, and so he has decided to use a Meccano Electric Horn for the purpose. The device is shown in Fig. 265, and although its efficiency is doubtful when subjected to the severe jolting caused by rough roads, it is likely to be of use for numerous other purposes to which an electric bell or buzzer can be put. The Clip 8 can be removed if necessary, so that the model can be secured in position on a board, etc., by means of Wood Screws.

Angle Girders are used in the construction of the frame, and to make these quite rigid a Trunnion and a 1" Corner Bracket are employed. The Clip 8 consists of a $4\frac{1}{2}''$ Strip curved to fit the top tube of the bicycle. In curving the Strip it is a good plan to obtain a rod or pipe of the correct size and shape the Strip round this.

The electro-magnet 1 is formed from a Bobbin wound with No. 26 gauge cotton-covered wire. A Pole Piece inserted in the centre of the Bobbin secures it to a $1\frac{1}{2}''$ Angle Girder to which also an Angle Bracket is fixed. Reversed Angle Brackets and 2" Strips attach this Girder to the 3" Girders, one of which has been cut away in the illustration to show the mechanism more clearly. The Strip 2 is attached to the frame by an Angle Bracket, and a Pendulum Connection 3 is secured to the Strip which, being held at one end only, easily vibrates. The Silver Tipped Contact Screw 5 is passed through the centre hole of a $1\frac{1}{2}''$ Strip that connects the 3" Angle Girders, but is insulated from the Strip by fibre Bushes and Washers.

Two Wheel Flanges clamp the metal diaphragm, which is a circular disc of thin sheet metal. Three holes are drilled in this, two to take the 2" Screwed Rods that hold the diaphragm in position, and the third in the centre for securing the Bolt 4. The Screwed Rods clamp the two Wheel Flanges together but should not foul the diaphragm. A suitable horn is cut from a piece of sheet metal or cardboard and is attached by Angle Brackets to one of the Wheel Flanges.

Fig. 265



One of the wires from the electro-magnet 1 is "earthed," that is connected to the frame of the model; and the other wire is led to the insulated Terminal 7. The Contact Screw 5 is connected to the Terminal 6, which is also insulated from the frame. The Pendulum Connection 3 normally makes contact with the tip of the Screw 5, thus completing the electric circuit and energising the magnet, which attracts the Strip 2 towards it. This causes the Bolt at the end of the Strip to strike the Bolt 4 on the diaphragm. Immediately the Strip is attracted to the magnet, the Pendulum Connection 3 also moves forward and so breaks contact. The Strip then moves back to its normal position and the cycle of operations is repeated in rapid succession. The result is that the Bolt 4 receives a series of blows, the noise being amplified by the horn.

(266) Clock Escapement

(A. Sheppard, Brighton)

The escapement mechanism shown in Fig. 266 is particularly suitable for use in small models such as mantel clocks. The driving spindle of the Motor carries a 2½″ Gear engaging a ½″ Pinion on a secondary shaft, which carries the two Ratchet Wheels 1 mounted with their Bosses butted together. A short Rod journalled above the secondary shaft carries two Pawls 2 and 3, and a Coupling on the other end of the Rod holds a 2″ Rod hanging perpendicularly. On the lower end of this Rod a second Coupling is mounted at right-angles, and fitted with two 1″ Rods in the end transverse holes. The latter Rods engage Collars secured on the pendulum, which is suspended by means of a Pendulum Connection held in Strip Couplings.

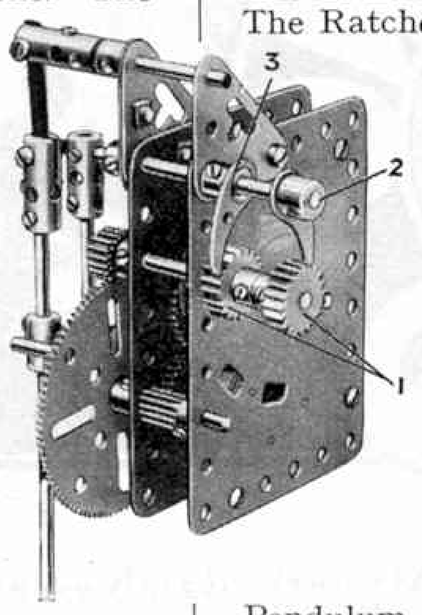


Fig. 266

The Pawls should be carefully adjusted so that it is not possible for them both to be clear of the Ratchets at the same time, as this would allow the Wheels to rotate freely. The Ratchet Wheels rotate in a clockwise direction so that the Pawl 3, when in engagement, prevents rotation of the secondary shaft. As the Pendulum swings over, this Pawl is released and the part 2 engages its respective Ratchet. In this case the movement of the Wheel is not stopped entirely and there is a tendency for it to continue to rotate, thus forcing the Pawl out of engagement. This helps the Pendulum to swing back until the Pawl 3 again engages its Ratchet. The positions of the Pawls in respect of the Pendulum is important, and also the positions of the teeth on the Ratchets in relation to each other. The most effective positions can be obtained after experimenting.

(267) Remote Control for Gear-Box

(L. F. Atkinson, Croydon)

There is much fascination to be derived from controlling a model without touching it by hand, but by operating a switchboard some distance away. The realism of a working model is increased enormously. The Meccano Electric Motor may be stopped and started from any distance merely by operation of a switch completing the electric circuit, and by means of the remote control device shown in Fig. 267 it can be made to go through all its movements without being touched. The device is intended for operating a two-speed gear-box from a distance, and in a model with several movements it will be necessary to fit a controller for each movement. In a model Crane, for instance, hoisting, luffing and slewing operations could be carried out at will by operating the appropriate switches.

The two-speed gear-box shown in the illustration is mounted between 2½″ × 2½″ Flat Plates and the Motor side plates. The drive from the armature shaft of the Motor is conveyed through Sprocket gearing to a 1½″ Rod journalled between one of the Motor side plates and a 2½″ × 2½″ Flat Plate. The Rod carries a ½″ Pinion that is constantly in mesh with the Gear 1 on a sliding 3½″ Rod, which carries also a ½″ Pinion 2 and a ¾″ Pinion 3. A Collar at each end limits its longitudinal movement. The final driven shaft consists of a further 1½″ Rod journalled co-axially with the first in the opposite Motor side plate and Flat Plate. The Motor and Flat Plates should be carefully placed so that these two Rods are in proper alignment.

The selector consists of a Crank 6 the web of which fits between the Gear 1 and Pinion 2, being spaced from the Gear by Washers. The boss of the Crank is fitted on a sliding 4½″ Rod the ends of which project beyond the Plates and are inserted in the solenoids 4 and 5. These are clamped in position by 2½″ Strips secured at each end to Double Brackets, and the lower Strips carry Angle Brackets centering the solenoids. Careful placing is necessary to allow free movement of the sliding Rod carrying the selector 6.

The gear control switch is shown near the Motor reversing switch for convenience, but this can be taken to any position and wired up accordingly. A 1″ Triangular Plate is held on a ¾″ Bolt 7 by two Nuts, and two further Nuts hold it in position on the Motor. Two 6BA Bolts 8 and 9 are insulated from the Triangular Plates and form studs for the contact arm made from a 1½″ Strip mounted on the Bolt 7, and held against the heads of the 6BA Bolts by a Compression Spring. The Bolt 8 is connected to one wire of the solenoid 4, the remaining wire of which goes to one of the Motor terminals. The same terminal is connected to the solenoid 5, which is wired to the Bolt 9. To connect up, one of the Accumulator wires goes to the remaining Motor terminal and the other is "earthed" by connecting it to the frame. With the lever as shown the solenoid 5 is in series with the Motor and causes the Crank 6 to bring the Pinion 2 into mesh with the 57-teeth Gear, at the same time throwing the Pinion 3 out of engagement with its respective Gear. When the control lever is moved to the left to make contact with the Bolt 8 the solenoid 4 is energised, causing the Pinion 3 to engage its Gear Wheel. The Bobbins should not be wound to full capacity.

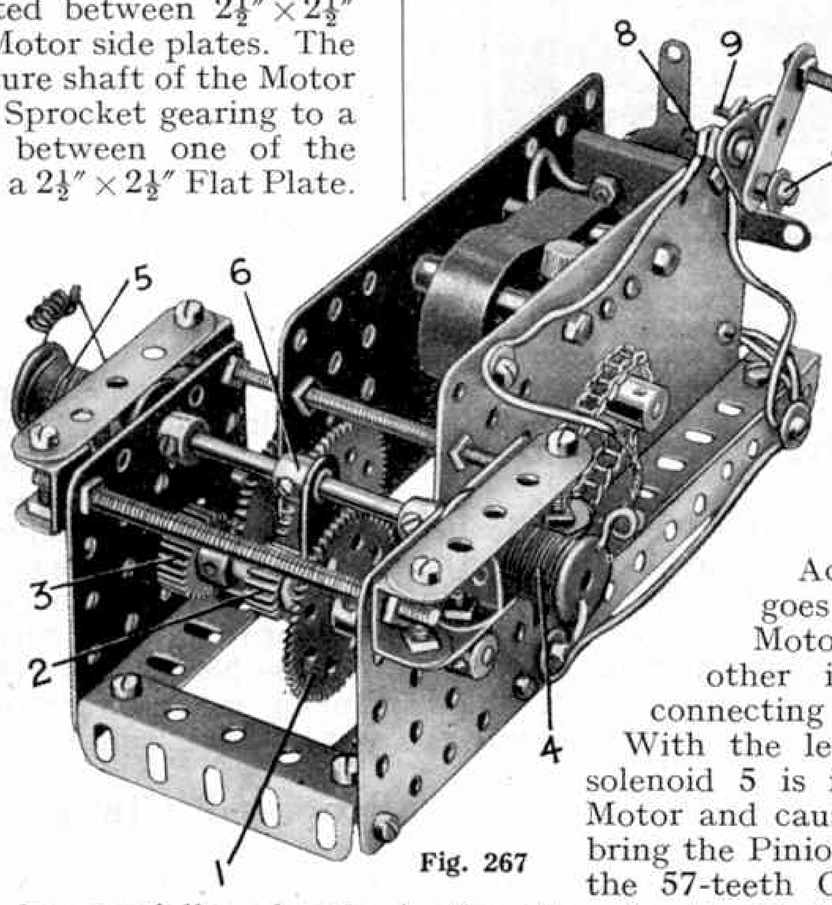


Fig. 267

Miscellaneous Suggestions

Under this heading "Spanner" replies to readers who submit interesting suggestions regarding new Meccano models or movements that he is unable to deal with more fully elsewhere. On occasion he offers comments and technical criticisms that, he trusts, will be accepted in the same spirit of mutual help in which they are advanced.

(M.147). A Novel Indicator for Cranes. In Cranes employing multi-sheave Pulley Blocks it is essential that the hoisting cord should always remain taut, otherwise it is likely to slip off the pulleys. When the pulley block reaches the ground the hoisting barrel should immediately cease paying out, but if the operator is unable to see the ground a short interval may elapse before he applies the brake.

L. Kent (Felixstowe) has devised an ingenious method of showing when the ground hook is relieved of its load, and at the same time keeping the cord taut if the drum pays out a little too much. The device consists of an Axle Rod pivoted near the centre to the jib, and carrying at its lower end a Worm or other suitable weight. An End Bearing at the upper extremity of the Rod carries a ½″ loose Pulley. The hoisting cord passes over the Pulley and the weight of the load hook should be sufficient to hold the lever in a position almost parallel to the jib. As soon as the hoisting cord is relieved of its weight when the Pulley block reaches the ground, the Worm at the end of the lever returns it to the vertical position, thus taking up the slack in the cord and giving the crane operator warning to apply the brake.

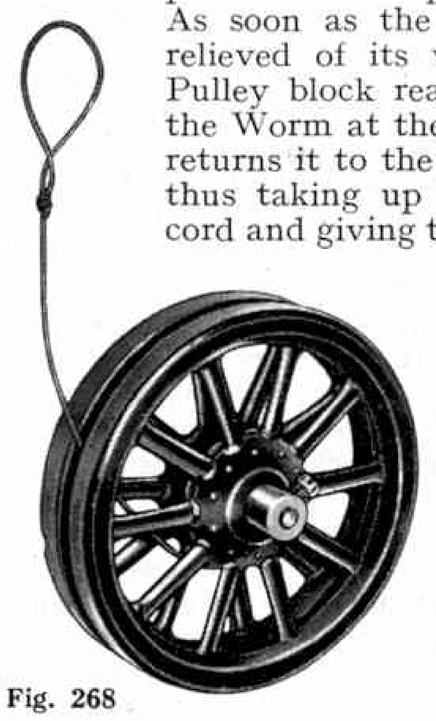


Fig. 268

(M.148). Coupling for Sliding Shafts. The usual form of connection between a sliding and a fixed rod consists of two Bush Wheels, one of which is fitted with Threaded Pins that engage the holes in the other. Occasions sometimes arise when the diameter of the coupling prohibits its use, and J. V. Harding's (Edgbaston, Birmingham) sliding joint will be found useful in such cases. A 2″ Slotted Strip is secured to each side of a Coupling on the fixed rod, and a second Coupling carried on the end of the sliding shaft is fitted with two Set Screws, which pass through the slots in the Strips.

(268) A Meccano Yo-Yo

(J. H. Axbey, Slough, and others)

Many readers are no doubt familiar with the "Yo-Yo," and those who have not yet mastered the art of manipulating one will obtain much enjoyment from the model shown in Fig. 268. As will be seen, this consists of two Artillery Wheels (part No. 19a) mounted on a 1½″ Rod with their bosses outward. A piece of Cord about a yard long is tied between the Wheels.

To operate the device the Cord is wound up and the end held while the Wheels are allowed to drop. In doing so the Cord unwinds and causes the Wheels to rotate, but after reaching the lower end of the Cord their momentum causes the Cord to be wound up again and the device begins to ascend. With a little skill it can be made to climb to its original position.

Planning Winter Programmes

During the present month many clubs will commence the activities of the first of the winter sessions of 1932-3, and the officials of those starting in October are now making plans in order to be in a position to start well. Much depends upon the careful consideration that Leaders and other officials give now to various possibilities. The first requirement is provision for Meccano Model-building, the hobby that brings members together; and when this part of the programme has been settled a choice may be made of games, additional hobbies and other activities that introduce a variety of interest. These hobbies and recreations should be selected in accordance with the wishes of members themselves, of course, but it is not advisable to concentrate on one particular pursuit, however popular this may at first appear, for a proportion of members may grow tired of it, and unless an alternative interest is quickly forthcoming, their enthusiasm for club work in general may be damped.

A regular programme should be organised at the beginning of the session, and this should be adhered to except in unforeseen circumstances. If members are interested in different hobbies, alternative programmes should be arranged as far as possible in order that each may follow his own bent. In addition, it is a wise plan to make the programme more elastic by leaving a few nights open. This practice is followed regularly by one Leader, who regularly delegates the task of arranging the programmes on "Selection Nights," as they are called, to small groups of three or four members. These do not reveal their plans until the night on which their programmes are to be followed, and their "dark hints" of bright ideas worked out in secret invariably arouse the greatest curiosity and interest among members, with the almost inevitable result that there is a splendid attendance when the great night comes round, and members are eager to join in the programme arranged.

Meccano Club Leaders

No. 60. Mr. C. H. Tuck

Mr. C. H. Tuck is Leader of the John O'Gaunt (Lancaster) M.C. This club was affiliated in January, 1930, and has made excellent progress under Mr. Tuck's skilful leadership, in spite of many difficulties, the members being loyal and enthusiastic.

Friendly Persuasion in Recruiting

The beginning of the winter session is an excellent time for a recruiting campaign. This may take one or more of many forms, but there is no doubt that the best results follow the efforts of members themselves to persuade their friends of the advantages of association with the Meccano club. Friendly persuasion works wonders also in reviving the interest of old members who have not kept in touch with the club during the summer, or whose attendance at meetings have been irregular; and usually this is best exerted by the Leader himself in a quiet chat on the club and its prospects. Such a talk may end with a cordial invitation to share in the good things arranged for the coming session, but in many cases the quiet assumption that membership is to be renewed is sufficient, and the boy will feel that the Leader is genuinely interested in his welfare.

Mystery Rambles and Treasure Hunts

I have been greatly interested to note how quickly Meccano clubs have followed the prevailing fashion of arranging mystery excursions. These usually have taken the form of rambles carefully planned to cover new ground in order to maintain the interest of members to the end. An outing of this kind can only be a success if the novelty is kept up throughout the programme, for to be led along familiar and well-trodden pathways is very disappointing to a boy who has turned up full of eager interest to take part.

It is not yet too late to arrange a ramble planned on these lines, for the weather during September often is as favourable as that of the summer months, and I strongly recommend Leaders in search of an effective ending to the outdoor season to arrange a "mystery tour."

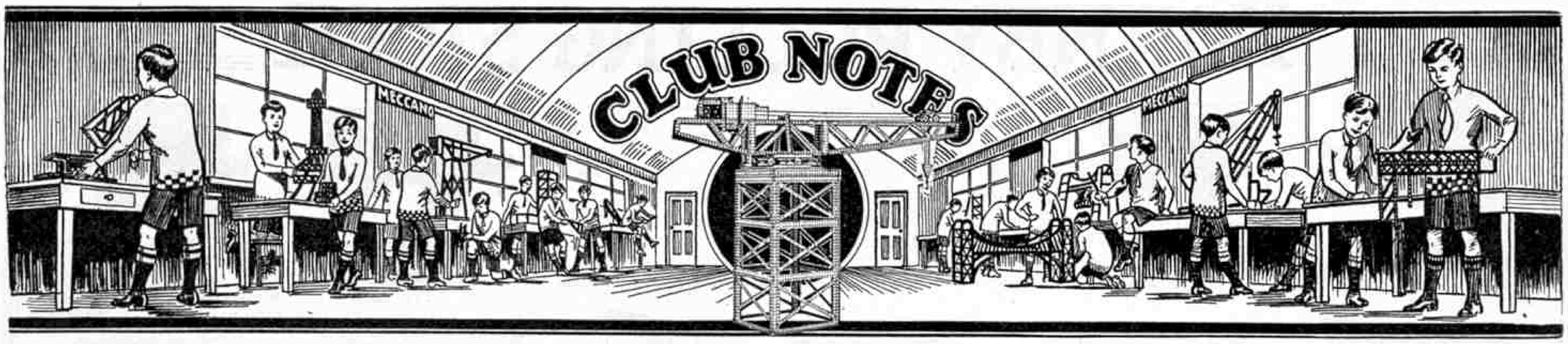
An alternative to a ramble of this kind as a wind up to the summer programme is a treasure hunt of the novel type introduced in the Fulstow Junior M.C. The clues to the whereabouts of a secreted "hoard of money" were written on the back of a jig-saw puzzle, the parts of which were hidden among the trees and bushes in a large garden. No steps for the recovery of the treasure could be taken until every portion of the puzzle had been found and fitted into its place, and members therefore first searched for these. Then followed the task of arranging these sections in order to finish the clues. Each member interpreted the clues for himself and set out to the place where he thought the treasure was to be found, and the first to reach it retained it as his prize. Small prizes were given to those who found the greatest number of portions of the jig-saw puzzle itself.

If it is thought desirable to increase the difficulty of the task set to members taking part in a treasure hunt, a series of clues could be arranged, each of these directing the seekers to the next one. This plan is ideal when sufficient time is available, the treasure being hidden near the starting point and the clues leading members to it by a circuitous route. If care is taken to place the clues in pleasant surroundings, the task of hunting them down will be healthy as well as exciting for if care is exercised in arranging it, an event of this kind may be made to combine the virtues of a ramble and a treasure hunt.

Proposed Clubs

Attempts are being made to establish Meccano Clubs in the following places, and boys interested in becoming members should communicate with the promoters whose names and addresses are given below:—

DUTCH EAST INDIES—Jan Stigter, Tjilendek 47, Buitenzorg.
SOUTH AFRICA—P. K. Wiener, Balcairn, Eden Road, Claremont, C.P.
SOUTH ASHFORD—George Kirby, 5, Kither Road, Beaver.
TORQUAY—B. Simons, 12, Daison Cottages, Lymington Road.
WINCANTON—Harry Carr, The Red Lion, Wincanton, Somerset.



St. Colombas (Sunderland) M.C.—The club has been reorganised, two teams known as the "Blues" and the "Whites" having been formed for competition purposes. A special feature is made of building one type of model with Outfits of different sizes, those constructed showing interesting differences in scope. Several rambles have been arranged, one in the form of a "Mystery Excursion" arranged by the Leader. Club roll: 14. *Secretary:* D. Ferguson, 9, Edward Burdis St., Southwick, Sunderland.

Bridport Grammar School M.C.—Woodwork, Fretwork and Stamp Collecting are being actively carried on, and interest in Model-building is being stimulated by means of Competitions. Books in the Library are in great demand, and the Cycling section is pursuing an interesting programme. Club roll: 23. *Secretary:* R. Hyde, 6, Melville Sq., East Street, Bridport, Dorset.

Mallow M.C.—A special Social Evening was held to celebrate the Anniversary of the club's affiliation, and this was followed by an attractive Exhibition. At ordinary meetings special nights are devoted to Scientific Experiments, in many of which excellent use is made of Meccano models. The Magazine grows in popularity, the demand from non-members being so great that extra copies of recent issues have had to be printed. Club roll: 16. *Secretary:* W. J. Roche, 8, Spa Walk, Mallow, Co. Cork.

Laindon (Essex) M.C.—One of the most interesting evenings so far arranged consisted of a Mock Broadcast Programme relayed from the next room by means of a wireless set and loud speaker. Model-building and Timetable working on the club's Hornby Train layout have been varied by Games and Rambles, and Cycle runs in the country have been greatly enjoyed. The newly-formed Stamp Collecting section is very popular and as a result a better-regulated interest is being taken in this hobby. Club roll: 11. *Secretary:* J. P. Tourle, "St. Ives," Leicester Road, Laindon, Essex.

Fulstow Junior M.C.—The club's third birthday was celebrated by a Social Evening at which games were played. Bagatelle matches against a team organised by Mr. E. H. Foat, the Schoolmaster, have been played in the club room and at the school, small prizes being awarded to the winners and the games being followed by refreshments and singing. Cricket, Cross-country Walking and Midget Golf on the lawn of Mr. W. R. Phillips, Leader of the club, are the chief summer activities. Club roll: 15. *Secretary:* J. C. Phillips, P.O. Fulstow, Lincs.

Entwelve (London) M.C.—Members meet regularly for Games and to make arrangements for visits to the open-air baths at Finchley, Rambles and other summer activities. The Stamp Section continues to thrive and its activities have greatly increased members' interest in this hobby. Club roll: 16. *Secretary:* A. F. Bailey, "Lenabo," Friern Park, N. Finchley, N.12.

Gourock High School M.C.—A Model-building Contest in which members were required to submit models of Locomotive Coaling Plants led to the production of many models of excellent design and construction. Papers on various subjects of engineering interest have been contributed by members, and a feature that was greatly enjoyed at one meeting was the reading by Mr. A. M. Nisbet, Leader of the club, of extracts from Kipling's book, "*The Day's Work.*" Club roll: 9. *Secretary:* W. Brown, 2, Grenville Rd., Gourock.

Welcome (Woolwich) M.C.—The indoor programme includes Model-building Evenings, Talks by members and First Aid demonstrations by the Leader, Mr. J. Martin. Members are keenly interested in Model-building and many of them attend the club room on two or three nights each week. Cricket is another popular activity and other outdoor sports also are being arranged. Club roll: 18. *Secretary:* F. J. E. Broomfield, 15, Lower Pellipar Road, Woolwich, London, S.E.18.

Our photograph shows members of the Greenock Academy M.C. at the summit of Ben Arthur, locally known as the "Cobbler" Mountain. The 45 boys and three masters who climbed to the top from Arrochar were well rewarded by the magnificent view. This club was affiliated in March 1926, and its members are very keen and active.

AUSTRALIA

Melbourne M.C.—The Exhibition held in conjunction with the Melbourne Branch of the H.R.C. was a wonderful success, the attendance exceeding 1,000, and the proceeds amounting to nearly £18. The models on view included a Ship Coaler, a Marine Engine, a Motor Chassis controlled from a distance through a length of flex, and a large range of Aeroplanes, Motor Cars, Tramcars, Cranes and Boats, all made by members, together with super models kindly lent by E. G. Page & Co., Sydney, and H. Small Pty. Ltd., Melbourne. Other interesting events have included visits to the printing and publishing office of "*The Age*," and to a local Hobbies' Exhibition. Several Model-building Competitions have been held, while the secretary and treasurer contributed talks on recent visits to Sydney, where the treasurer was present at the opening of the Sydney Harbour Bridge. Club roll: 48. *Secretary:* L. Ison, 8, Hayes St., Northcote, N.16, Victoria.

Sydney M.C.—Members were greatly interested in a Meccano model of a Wool Scouring machine exhibited by Mr. A. Lord, President of the club. A Lecture on "*Railway Signalling*" was given by Mr. H. H. Matthews, and interesting visits have been paid to a model town constructed and exhibited by Sir G. Julius, and to the Eveleigh Locomotive Sheds. Members have been active in general Model-building and a series of interesting contests has been keenly contested. Club roll: 25. *Secretary:* W. J. T. Watson, 595, Parramatta Rd., Leichhardt, N.S.W.

GERMANY

Berlin M.C.—A new club room has been secured and put in good order by members. Model-building continues to be the chief activity, and table tennis and chess also are played. A visit to a Museum of Transport was exceptionally interesting, and several topics for Debates were noted. Club Roll: 13. *Secretary:* H. Kobrak, Alt Moabit 83c, Berlin.

NEW ZEALAND

Hawera M.C.—Members continue to show great enthusiasm in Model-building Contests, and special Simplicity Competitions have been arranged in addition to the regular Contest organised monthly. Models built by members, including one of the Sydney Harbour Bridge, were displayed at a local Flower Show, where they attracted much interested comment. Talks have been given by Mr. A. H. Larkman, President of the club, on "*The Force of Gravity*," and by Mr. S. Phillips, Leader, on "*Welding*"; while members have contributed short talks on the "*Cierva Autogiro*," "*Canadian Locomotives*" and other topics. Club roll: 15. *Secretary:* B. Cox, Tawhite Road, Hawera, N.Z.

SOUTH AFRICA

Berea M.C.—This club has made excellent progress and has now been affiliated. At a special inter-club meeting, models built by members of the Berea and Yeovil clubs were judged by Mr. Sykes, Leader of the Malvern M.C., and Mr. Simpkins, a representative of Mr. A. E. Harris. The competition was keen, Yeovil M.C. leading by a fraction of a point. A Microscope Evening has been held, a member bringing his instrument to the club room and showing a number of interesting slides. Club roll: 14. *Leader:* Mr. J. Epstein, 22, Abel Rd., Johannesburg.

St. Saviour's (Raynes Park) M.C.—Affiliation has now been secured, the club meeting in the Church hall, by kind permission of the Vicar, the Rev. M. L. Couchman. A varied programme of Model-building, Lectures and Outings has been arranged, and at special meetings a talk and demonstration by Mr. R. Morgan on "*Lubrication*," and a Lantern Lecture on "*London's Underground*" have been given. Under the guidance of Captain Gordon Brown the club has visited the Houses of Parliament and the London Museum, while great enthusiasm was aroused on the occasion of the club's visit to the final rehearsal of the R.A.F. Display at Hendon, held on the day before the event itself. Club roll: 19. *Secretary:* R. Woollcott, 33, Crossway, Raynes Park, S.W.20.

King's Lynn M.C.—A local troop of Boy Scouts was entertained recently, and a special display was made of models built by members, together with the Ship Coaler on loan from Headquarters. Practical Model-building tests are being organised, and badges are to be awarded to members who pass these. The chief summer recreation is Tennis, played on the lawn kindly placed at the disposal of members by Mr. I. J. Thatcher, President of the club. Club roll: 25. *Secretary:* G. D. V. Dey, 11, Railway Road, King's Lynn.

Fallowfield Baptist Life Boys' M.C.—A successful start has been made, the first efforts of members being devoted to the construction of models for a Handicrafts Exhibition held at Weaste. These attracted great interest, a large model of the Forth Bridge shown in connection with a Hornby Railway layout being particularly admired. During the summer model bridge-building operations out of doors have been undertaken, members being keen to overcome difficulties similar to those experienced in large scale bridge-building work. Models of ships also have been constructed for use in illustrating a lecture to be given by the secretary. Club roll: 30. *Secretary:* H. Nelson, Lightbown, 9, Albion Road, Fallowfield, Manchester.

King's School (Peterborough) M.C.—Model-building Evenings have included an Aeroplane Night, when Meccano Aeroplane Constructor parts were put to good use; a Warfare Night, on which models of ancient and modern weapons were built, and Simplicity Nights. Special prizes were given by Mrs. Shearcroft, wife of the President of the club, and these have excited keen rivalry among members. Other interesting evenings have been devoted to Hornby Train operations. Club roll: 32. *Secretary:* R. A. Hughes, 186, Lincoln Road, Peterborough.

Forfar M.C.—Excellent progress is being made. The standard of Model-building in the competitions arranged regularly is high, notable efforts including an excellent Submarine, a model of the "*Bluebird*," and a Steam Tug. The club works in association with the clubs at Tayport and Dundee, and special attention is given to Swimming, Tennis and Golf, matches between the clubs being arranged regularly. Club roll: 23. *Secretary:* J. Barrett, 8, Little Causeway, Forfar.

St. Edmundsbury M.C.—Recent social events have yielded the sum of £9 3 0, and after deducting expenses, a Gramophone and a Meccano Aeroplane Constructor Outfit were bought. The local Gas and Electricity Works and a Printing Works have been visited, and a special Lecture has been given on "*Motor Car Construction*," this being illustrated by means of the Meccano Motor Chassis on loan from Headquarters. The secretary will be pleased to hear from any boy wishing to join the club. Club roll: 22. *Secretary:* H. J. Minns, 35, Out Risbygate, Bury St. Edmunds.

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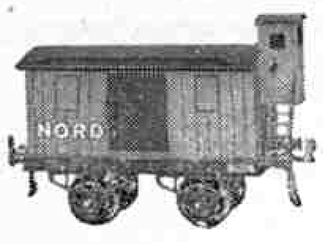

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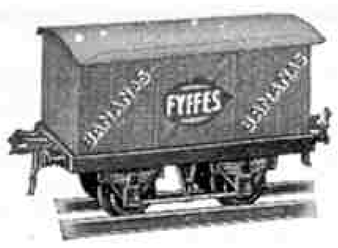

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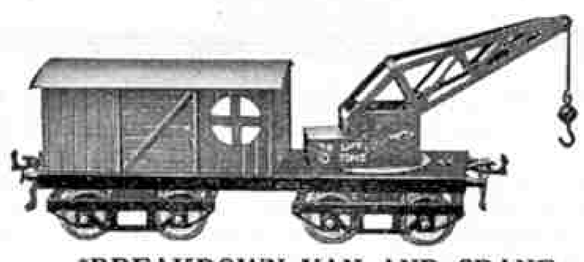

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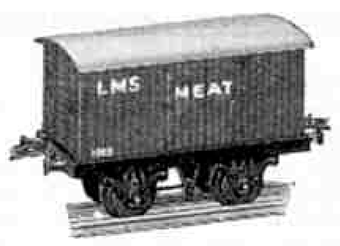

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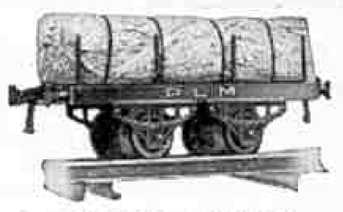

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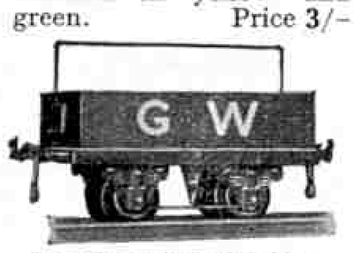
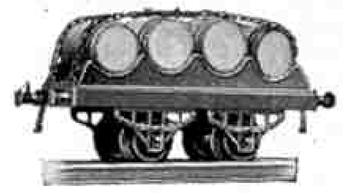
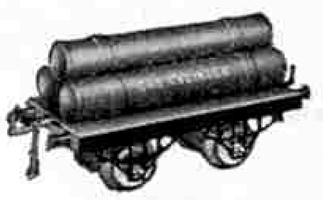


***OPEN WAGON "B**
Similar to Hornby Wagon No.1, but fitted with centre tarpaulin supporting rail. Price **2/3**

MITROPA COACH No. 3
Lettered "Mitropa," with either "Speisewagen" or "Schlafwagen" in gold. Beautifully finished in red enamel with white roof. Price **15/6**



BARREL WAGON
This is another interesting model of a type of wagon used in France and other European countries. Price **2/9**



GAS CYLINDER WAGON
Finished in red, lettered gold. Price **2/6**

SIDE TIPPING WAGON
Excellent design and finish. Lettered "Robert Hudson Ltd." Price **2/6**

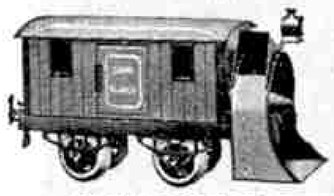
WINE WAGON, SINGLE BARREL
An interesting model of the single-barrel type of wine wagon used in France. Finished in red and green. Price **4/–**

No. 2 SALOON COACH
Realistic in design and beautifully finished. Two types are available: L.M.S. (as illustrated) enamelled maroon, and L.N.E.R. enamelled brown. Suitable for 2-ft. radius rails only. Price **11/6**

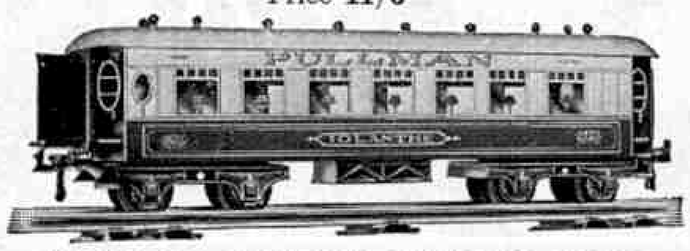
COVERED WAGON (French Type)
This wagon is fitted with frame and sheet. French type lettered "Nord." Price **3/–**

ROTARY TIPPING WAGON
Finished in blue and yellow. Price **3/–**

TIMBER WAGON No. 1
Beautifully enamelled in yellow and red. Price **1/9**

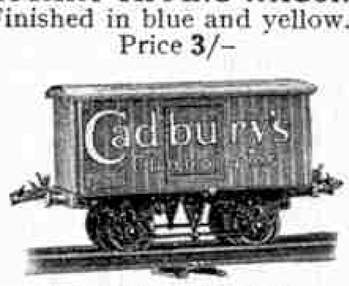


SNOW PLOUGH
With revolving plough driven from front axle. Price **5/6**



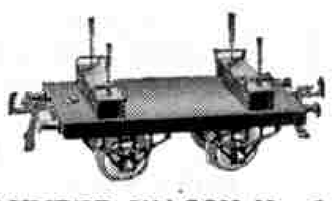
HORNBY No. 2 SPECIAL PULLMAN COACH
As supplied with No. 2 Special and No. 3 Pullman Train Sets. This splendid coach is perfect in detail and finish. Suitable for 2-ft. radius rails only. Price **15/–**

***REFRIGERATOR VAN**
Beautifully enamelled. Fitted with opening doors. Price **3/–**



CHOCOLATE VAN "CADBURY'S"
This new van is beautifully enamelled in blue with orange roof. Price **3/–**

***GUNPOWDER VAN**
Finished in red. With opening doors. Price **3/–**



LUMBER WAGON No. 1
Fitted with bolsters and stanchions for log transport. Price **2/–**

TROLLEY WAGON
Finished in brown and blue. Suitable for 2-ft. radius rails only. Price **4/6**

***CATTLE TRUCK No. 1**
Fitted with sliding doors. Very realistic design. Price **3/–**

MILK TANK WAGON "UNITED DAIRIES"
A very realistic model, finished in blue and white. Price **6/–**

BITUMEN TANK WAGON "COLAS"
Finished in blue. Price **5/3**

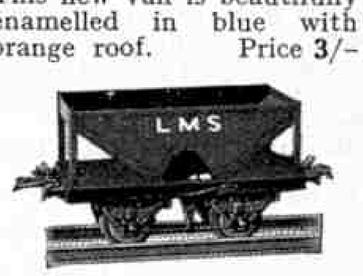
MITROPA COACH No. 0
Finished in red with white roof. Lettered "Mitropa," with either "Speisewagen" or "Schlafwagen" in gold. Price **1/6**

MILK TRAFFIC VAN No. 0
An attractive model. Available lettered G.W. only. Price **2/6**

COAL WAGON
This is similar to Hornby Wagon No. 1. It is fitted with embossed representation of coal. Price **2/3**

LUMBER WAGON No. 2
Fitted with bolsters and stanchions for log transport. Suitable for 2-ft. radius rails only. Price **4/–**

FISH VAN
This is a distinctive model. Available lettered N.E. only. Price **2/6**



SECCOTINE VAN
Beautifully finished in blue. With opening doors. Price **3/–**

In L.M.S., L.N.E.R., G.W. or S.R. lettering.

Manufactured by MECCANO LIMITED, BINNS ROAD, OLD SWAN, LIVERPOOL

Branch Notes

PANNAL ASH COLLEGE (HARROGATE).—The layout has been electrified, the central station now having four tracks. Realistic gradients have been constructed and scenery planned, while ballasting is complete. A large bridge carrying two tracks is being re-designed for mechanical operation, while further sidings are to be added in order to enlarge the scope for goods train working. The Art section of the College has kindly undertaken to paint the scenery built by members from wood and concrete. Secretary: P. D. Beckett, Pannal Ash College, Harrogate.

PLYMOUTH.—A different track is laid down for each meeting in order to provide variety in timetable passenger and goods working. A shunting competition has been held, points being awarded to the competitors who solved a special shunting problem in the least number of movements. Visits have been paid by sections of the club to the Laira Engine Depot of the G.W.R., those present on one occasion inspecting a "King" locomotive from below, and visiting the cabs of six other engines. Colour-light signalling is being installed on the Branch track. Secretary: S. Brenton, 53, Ford Hill, Stoke, Devonport.

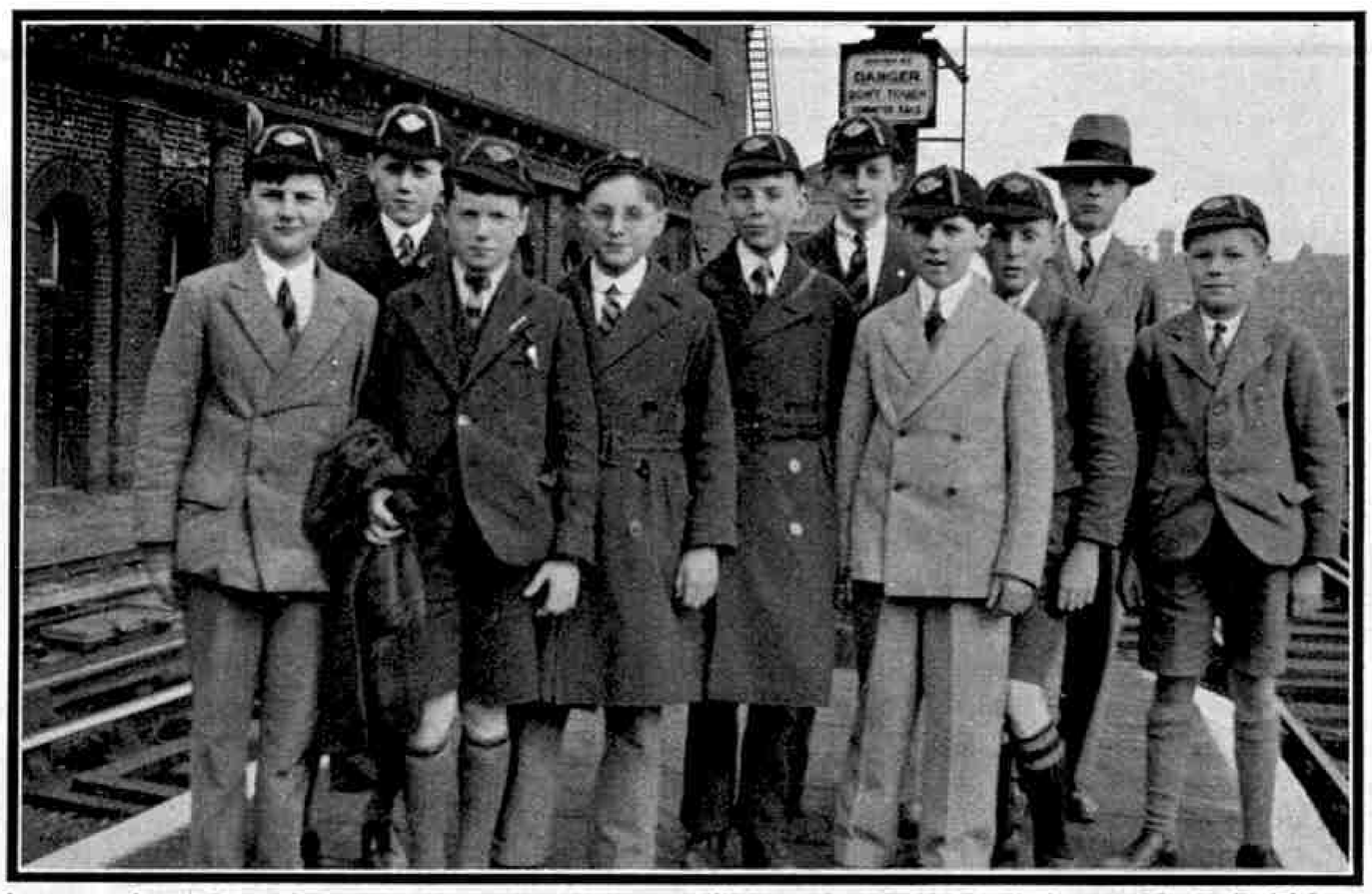
EAGLEHURST (PALMERS GREEN).—The track has been completely relaid and extended, a new table having kindly been presented by a friend of the Branch. The track is now 56 ft. in length. Cycle Runs and Cricket Matches have been the chief activities during the summer months, but organised track meetings are to recommence this month and new members will be heartily welcomed. Secretary: H. Hossent, 86, North Circular Road, Weir Hall Estate, N.18.

ST. AGNES CHURCH (HOVE).—The last indoor meeting took the form of a Games Evening to which the members of the St. Andrew's Boys' Club were invited. After Table Tennis, Quoits and other games, all enjoyed refreshments kindly provided by Mr. J. Crighton, Chairman of the branch. A cycling club has been formed and many interesting runs have been enjoyed. Cricket and other summer activities are also being followed. Secretary: R. Jenkins, 8, Frith Road, Hove.

SAFFRON LANE (LEICESTER).—A continuous track has been laid down and a timetable of operations lasting 30 minutes has been planned and successfully carried out, only one train being late on scheduled time. Tests for speed and power also have been made with the locomotives available, and plans for introducing electric express trains have been discussed. Secretary: J. Goodman, 128, Saffron Lane, Leicester.

CANNOCK HOUSE SCHOOL.—Excellent progress is being made, an attractive programme including visits to the Rotunda Museum at Woolwich, and to the exhibition of a film on "*South Africa*." A permanent layout consisting of two main lines with sidings and stations, a goods yard and an engine shed has been built up, the rails being screwed to boards in order to give first-class running. The Cannock House School magazine regularly includes full reports of Branch activities and recently published an excellent article by Mr. F. P. Montagu, Chairman of the Branch, on the ideals of the H.R.C. movement. Secretary: D. Wynbergen, Cannock House School, Eltham, Kent.

LORDSHIP LANE SCHOOL (LONDON).—The very successful track meetings have been varied by a visit to King's Cross, where members saw three "Pacifics" coupled together backing into the station and then visited the Locomotive Sheds, where they were photographed in front of 4–6–2 No. 4476, "*Royal Lancer*." Many new members have been enrolled. Secretary: R. Carrington, 49, Russell Avenue, Noel Park, N.22.



A group of members of the West Dulwich and Herne Hill Branch, No. 194. Chairman, Mr. E. P. Fisher; Secretary, J. Nunn. The Branch was incorporated in August, 1931, and members are divided into two sections known as "Pacifics" and "Baltics" respectively. Our photograph was taken during a visit to the London Bridge Signal Box.

WEST DULWICH AND HERNE HILL.—A regular feature at meetings is a Competition designed to increase members' knowledge of railway matters. An instructive visit has been paid to the London Bridge Power Signal Box, where members were interested in some plans of track circuiting. Secretary: John Nunn, 70, Herne Hill, London, S.E.24.

SOUTH WIGSTON.—Interest continues to grow and there was a splendid attendance when a visit was paid to the local L.N.E.R. sheds. There the workshops were inspected and afterwards the party rode round the sidings on three engines, one of which was 4–6–0 No. 6164, "*Earl Beatty*," which has just arrived from London. Secretary: H. H. S. Mansfield, 35, Westminster Road, Stoneygate, Leicester.

AUSTRALIA

SOUTH KOGARAH.—A room has been obtained in which a permanent layout may be constructed, and members have been busily engaged in making trestles and other necessary work. Great enthusiasm prevails at the prospect of being able to recommence track meetings, and an interesting programme is being arranged for the coming session. Secretary: H. M. Walsh, "Bringa," 220, Princes Highway, Kogarah, Sydney.

Further Branches in Course of Formation

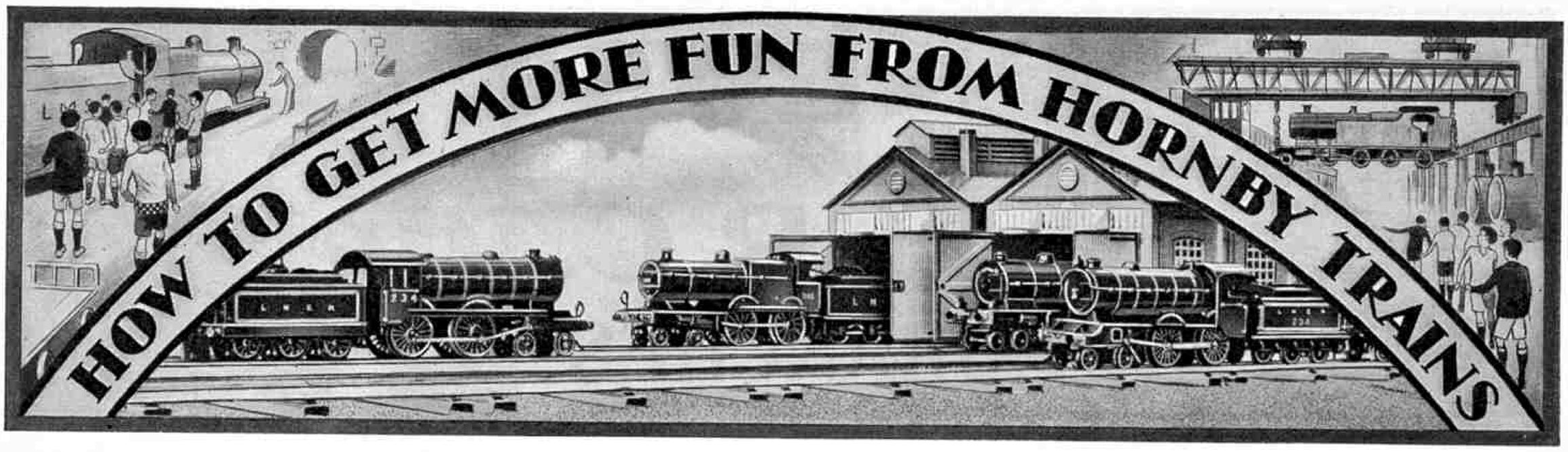
The following new Branches of the Hornby Railway Company are at present in process of formation and any boys who are interested and desirous of linking up with this unique organisation should communicate with the promoters, whose names and addresses are given here. All owners of Hornby trains or accessories are eligible for membership and the various secretaries will be pleased to extend a warm welcome to all who send in their applications:—

BAKEWELL—J. D. Broadbent, Bank House, The Square.

BROMLEY—D. Sexton, 41, Gundulph Road, Bromley.

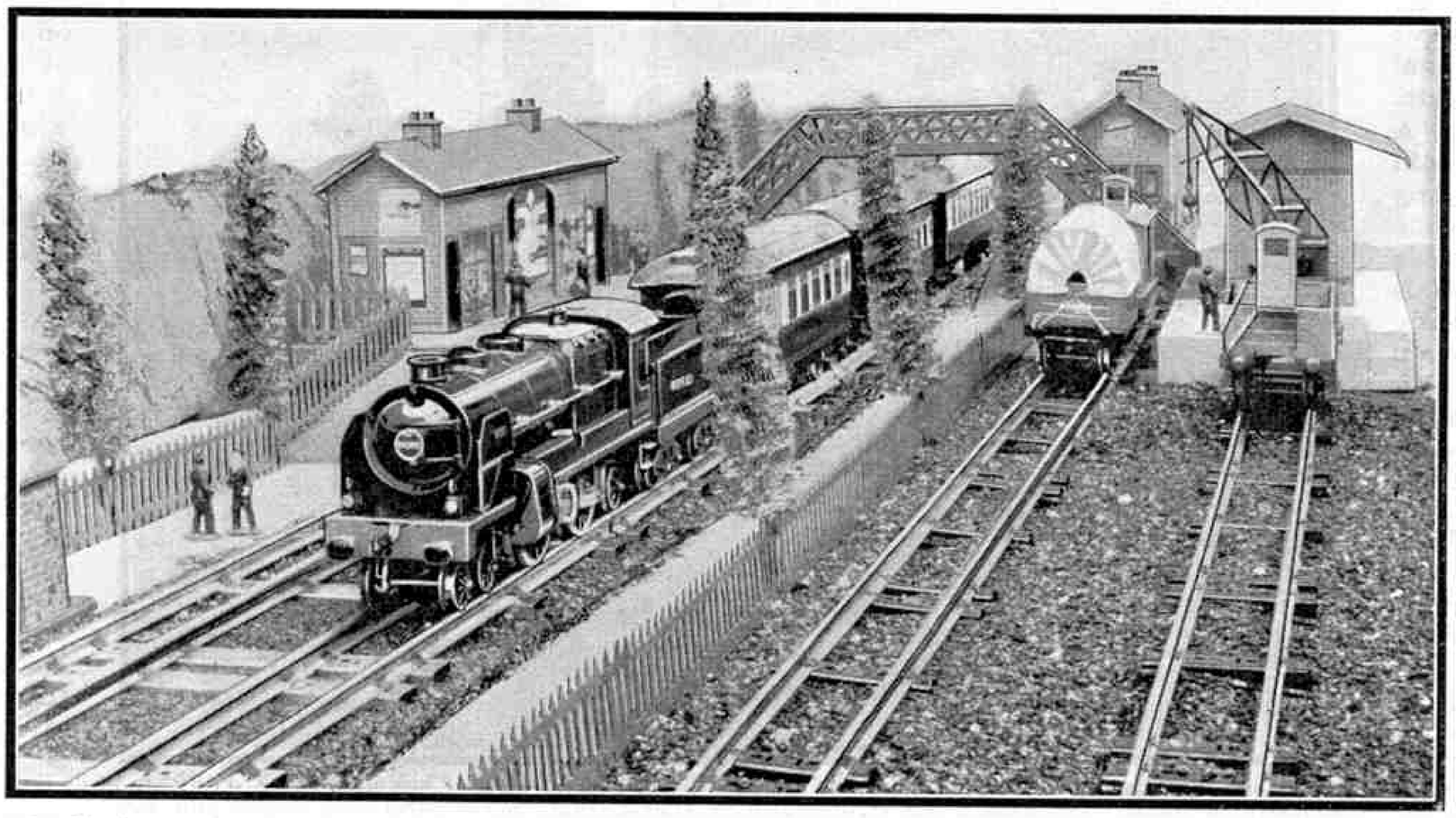
HILLINGDON—B. Kidd, "Stockham," Harlington Road, Hillingdon, Middx.

NEW ZEALAND—G. S. Davies, 17, Tolcarne Avenue, Maori Hill, Dunedin, South Island.



XLVII.—THE OPERATION OF FRENCH LAYOUTS

IN the June "*M.M.*" we described a scheme for operating a miniature railway system on which Anglo-French traffic was carried, the Channel Tunnel being supposed to be in existence in order to afford a connection between England and the Continent. Although this tunnel was first proposed many years ago and has received considerable attention at various periods, its construction has never taken place, and does not now appear likely to do so. However, the article in question proved extremely popular among readers in general, especially H.R.C. members, so that we think they will welcome the consideration of the various questions that affect a layout arranged to represent a railway on the other side of the Channel, possibly laid out as a development of the Channel Tunnel scheme.



An effective station layout on a miniature French system. The train shown represents the Nord "Golden Arrow," and the locomotives in this and the other illustrations have been fitted with the characteristic smoke deflectors suggested in this article.

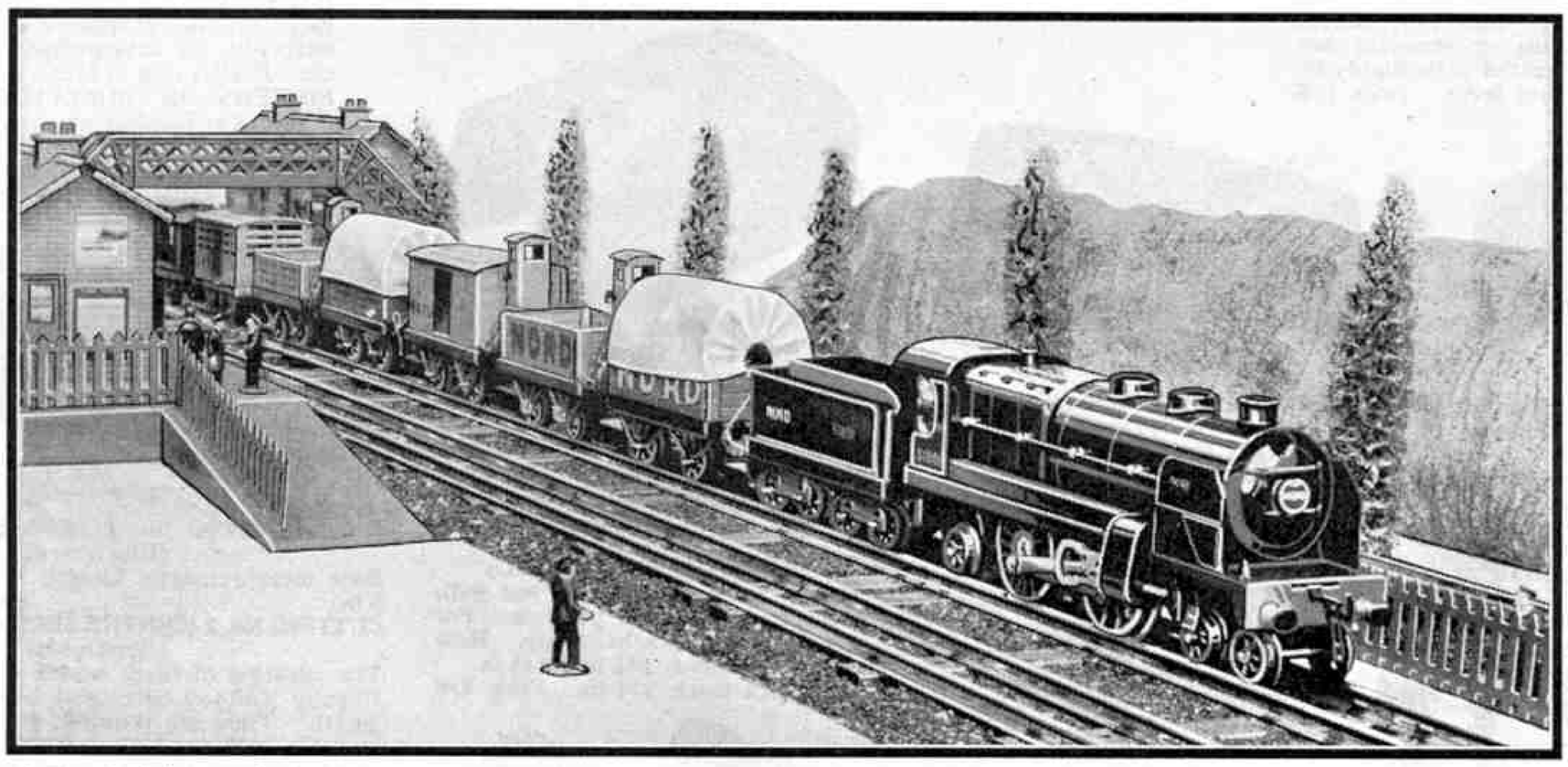
Many boys are owners of the well-known Hornby "Riviera Blue" Train Set, either clockwork or electric, and this may well form the nucleus of a collection of French type stock. The train is a splendid reproduction in miniature of the luxurious express that was inaugurated nearly 10 years ago as the "*Train Bleu*," and which runs from Calais through to Nice and Vintimille on the Riviera. It is particularly interesting in that the coaches were built in England to the order of the International Sleeping Car Company. The train is run over the Nord system from Calais to Paris, and at La Chapelle in the precincts of the city it passes to what is known as the Ceinture or Circular Railway. By means of this line it skirts the city and reaches the P.L.M. system at their Gare de Lyon, so continuing its journey southward. This course is also taken by other trains, such as the "*Rome Express*," that run through from North to South. This therefore is a point of working that should not be missed by those whose layouts are sufficiently extensive to allow a portion, at all events, of the Ceinture to be included.

There are both dining cars and sleeping cars in the Set, one of each being included; and a considerable improvement has been effected recently in providing them with the pattern of bogies with Mansell Wheels that are used for the Hornby No. 2 Special Pullman Coaches. The appearance of a miniature "Blue Train" is extremely smart, the gold lining and lettering on the dark blue coaches being particularly effective, while the roofs are painted an attractive shade of cream.

The locomotive provided will no doubt be familiar to most readers and in its general outline and characteristics is representative of up-to-date French practice. The large outside cylinders, the smoke-box front, the Belpaire pattern of fire-box, and the boiler fittings all combine to give a fine impression of a Continental express engine. The tender, too, is of the large double-bogie pattern developed on the Nord system owing to the lack of water troughs between Calais and Paris. An interesting addition to the front end of the engine will be the smoke deflectors as shown in the illustrations on this and the next page. These are made of thin card, as described in the May "*M.M.*" Painted black and picked out with white, if the ability of the owner permits, they look smart and have the effect of making the engine look very important. It will be realised, therefore, that a miniature "Blue Train" is extremely effective when assembled, and if its working in actual practice is reproduced the result will be of considerable interest.

As remarked previously the train is run round the outskirts of Paris, much in the same way as the well-known L.M.S.R. "*Sunny South Express*" passes from

that system over the West London and West London Extension railways to the Southern line, and so completes its journey. The working of this train in miniature was referred to recently in these pages, and there is no reason why the running of the "Blue Train" should not be equally fascinating. While passing over the Ceinture an engine belonging to that line replaces the Nord "Pacific," and for this purpose a Hornby No. 1 Special Tank will be the most appropriate engine; though sometimes a Nord or P.L.M. engine is used, so that we may occasionally allow our Nord 4-4-2 to work the train throughout. We may obtain the impression that it is a fresh engine, however, by detaching it from the train at the point where engine-changing is normally carried out, and after it has run to the Water Tank or Shed it may be allowed to back on to the train again. It will be remembered that this scheme was made use of in the operation of the miniature "Midland" system described in the *"M.M."* last April, when "engine-changing" at Derby was carried out in this manner.



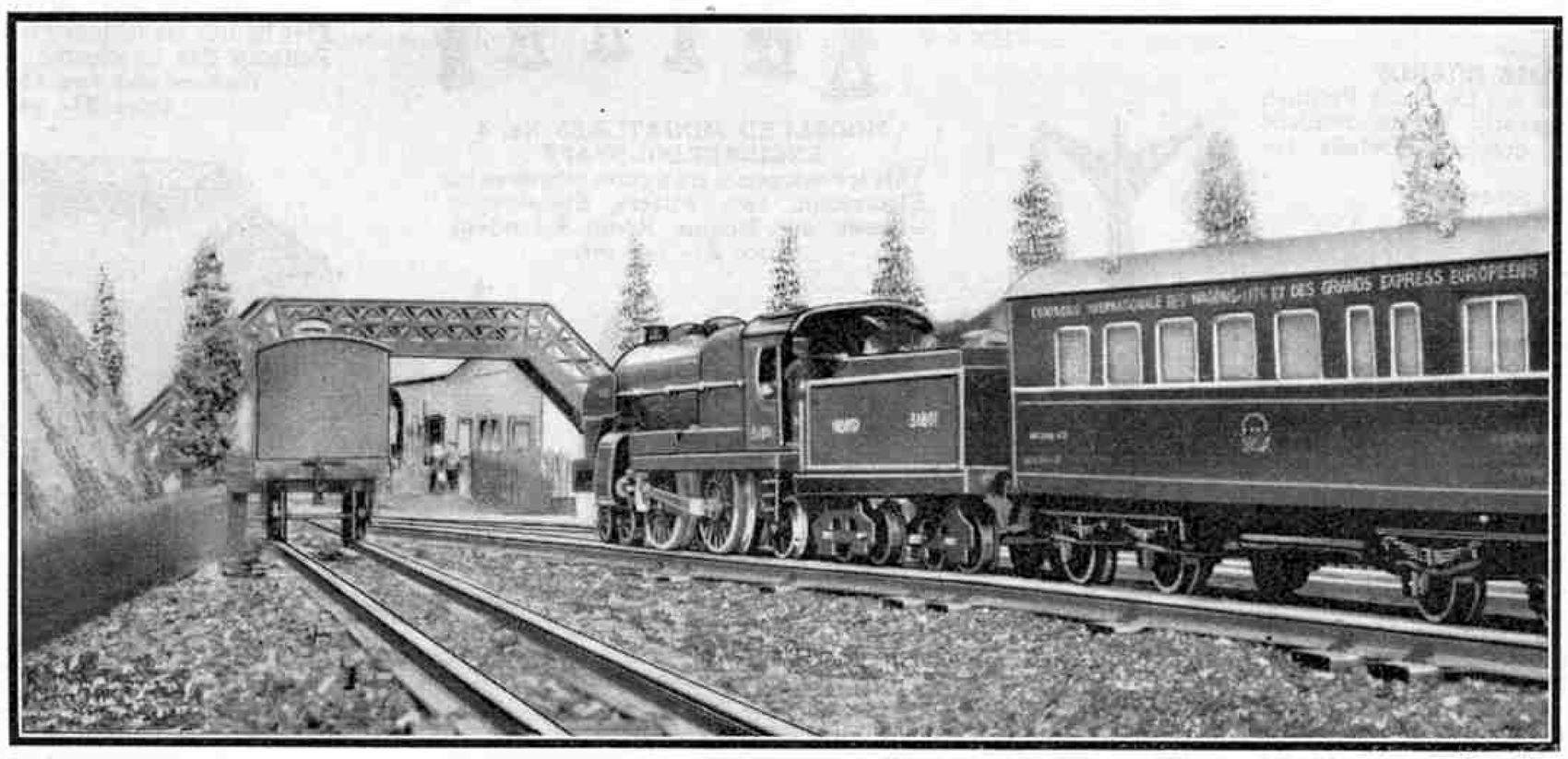
A French freight train hauled by a Hornby No. 3 "Riviera" Locomotive. The typical rolling stock enables a representative train to be made up, and its appearance is very realistic.

For the "Blue Train," however, we shall require to carry out this operation twice, as a P.L.M. express locomotive takes charge when the train gains that system after traversing the Ceinture.

As a rule it will not be possible to imitate two such large main line systems as the Nord and the P.L.M., but owners of continuous layouts may use the same track to represent these two railways in succession, the Ceinture being a loop line hidden from the rest of the track by Tunnels and Cuttings. An interesting point regarding the Ceinture is that a section of it that is used by the Ceinture Company for freight trains only has been taken over by the Etat system, and a service of electric trains is run over it. Therefore we may find employment also for a Hornby Metropolitan Train Set, in order to represent this service in miniature.

Returning to the Nord system again, especially as our chief locomotive represents that company, another well-known express that we can run is the "*Golden Arrow*." This was particularly referred to when dealing with the Channel Tunnel scheme, but it will be of advantage to recall that it is made up of Pullman cars that are run from Calais Maritime to the Gare du Nord in Paris. Its composition in miniature therefore requires Hornby No. 2 or No. 2 Special Pullmans, which make up into a very fine looking train. Where the line is arranged to represent actual present-day conditions, it will be necessary, both where this and the "Blue Train" are run, to arrange a quayside at Calais so that the marine element can be represented in a satisfactory manner. If a miniature steamer is not available, or there is no space for it, one may be painted or drawn on a piece of background scenery displaying the seaward view.

As regards freight traffic generally there are several points of interest. Quite a satisfactory range of French type rolling stock is available, and if through working via the Channel Tunnel is assumed, English vehicles of all descriptions may be used in addition. Some of the French wagons are similar to the English types, and others exhibit marked differences. Thus the Open Wagons are practically identical, except that the French pattern has a small cabin at one end with steps leading up to it. This in actual practice is for the accommodation of brakesmen riding on the train, and gives the vehicles a distinctive appearance. The elevated position of this enables the brakesmen to observe the running of the train quite easily. A curious piece of rolling stock is the Covered Wagon which is not, as might at first be supposed,

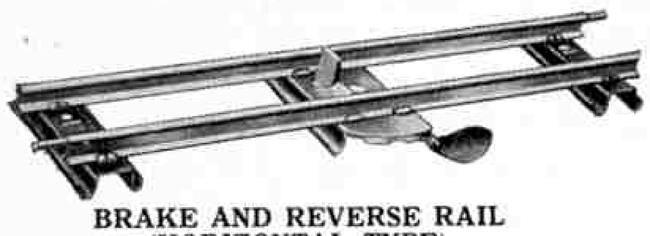


An unusual view showing the well-known Hornby "Riviera" Blue Train approaching a station. The features of the original locomotive and vehicles are well reproduced.

(*Continued on page 729*)

HORNBY ACCESSORIES

HORNBY SERIES



BRAKE AND REVERSE RAIL (HORIZONTAL TYPE)
This special rail is designed on an entirely new principle. It has independent catches for reversing or stopping the train. These are operated quite simply by means of one control lever. Price **1/6**

The range of Hornby Accessories, already comprehensive, has now been increased by the addition of a number of splendid new items. A selection of these is illustrated and described below. If you are a Hornby enthusiast you will appreciate at once the extent to which the new Tunnels, Cuttings, etc., will enhance the realism and effectiveness of your Hornby railway layout.

Ask your dealer to show you these new goods.

MECCANO LTD., OLD SWAN, LIVERPOOL

GAUGE 0

STATION HOARDING
This is a realistic accessory, suitable for the station platform. Price **8d.**

Station Hoarding

POSTER BOARDS to carry Hornby Miniature Posters. Provided with lugs for attachment to paled fencing, etc. Packet of 6 (3 large, 3 small), Price **6d.**

POSTERS IN MINIATURE are reproductions of familiar national advertisements. They are intended to be pasted on the Station Hoardings or the Poster Boards described above, and are beautifully printed in full colours. Packet of 51 ... Price **6d.**

TUNNEL No. 0 (Straight)
Length 6 in., width 6⅛ in. Price **1/6**
TUNNEL No. 1 (Straight)
Length 7 11/16 in. Width 6¼ in. (as illustrated). Price **2/-**
TUNNEL No. 2 (Straight)
Length 15⅜ in. Width 9½ in. Price **4/-**

TUNNEL No 3. (Curved)
Length 13 in. Price **4/6**
TUNNEL No. 4 (Curved)
(as illustrated)
Length 20 in. For 2 ft. radius tracks only. Price **5/6**

TUNNEL No. 5 (LEFT-HAND, CURVED)
(as illustrated)
This tunnel is in the form of a small hill, through which the track runs obliquely. For 2 ft. radius tracks. Base measurement: 15⅜ in. × 14⅜ in. Length of track 17¼ in. Price **7/6**

TUNNEL No. 6 (RIGHT-HAND, CURVED)
Similar to No. 5 Tunnel, but with track in the reverse position. For 2 ft. radius tracks only. Base measurement 15⅜ in. × 14⅜ in. Length of track 17¼ in. Price **7/6**

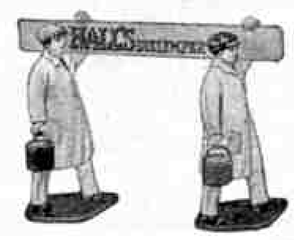
Two No. 1 and one No. 2 Cuttings are illustrated here.

CUTTING No. 1 (END SECTION)
(Illustrated)
Base measurement: Length 7 11/16 in., width 6 in. Price, per pair **3/-**

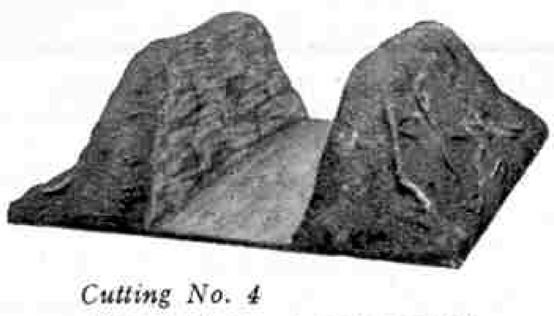
CUTTING No. 2 (CENTRE SECTION, STRAIGHT)
(Illustrated)
The addition of these centre sections enables a Hornby Railway cutting to be extended to any length. They are intended to be used in conjunction with the End Sections (Cutting No. 1), between which they are fitted.
Base measurement: Length 10¼ in., width 6 in. Price **2/-**

CUTTING No. 3 (CENTRE SECTION, CURVED)
This is used for curved tracks in the same manner as the straight centre section, described above, is used for straight tracks. It is suitable for both 1 ft. and 2 ft. radius tracks. Price **2/-**

MODELLED MINIATURES No. 1 STATION STAFF
These splendid models, which are beautifully enamelled in colours, add the final touch of realism to Hornby Station Platforms. Price **2/-** per set.



MODELLED MINIATURES No. 13 HALL'S DISTEMPER ADVERTISEMENT
This miniature of a well-known line-side advertisement is intended to be placed in the fields adjoining the railway track. Price **1/-**



Cutting No. 4

CUTTING No. 4 (STRAIGHT)
This is a double cutting, mounted on a base over which the railway track is laid.
Base measurement: Length 15⅜ in., width 15 in. Price **6/-**

MODELLED MINIATURES No. 21. TRAIN SET
This new miniature train set is a very attractive model. It includes die-cast Locomotive, Wagon, Crane Truck, Lumber Wagon and "Shell" Petrol Tank Wagon. Price **2/9**

MODELLED MINIATURES No. 5 TRAIN AND HOTEL STAFF
Five figures are included in this set, including Pullman Car Conductor, two Pullman Car Waiters and two Hotel Porters.
Price **2/-** per set.

TRAIN NAME BOARDS
These name boards are for No. 2 Pullman Coaches and add greatly to the realistic appearance of the coaches. Details are as follows:—

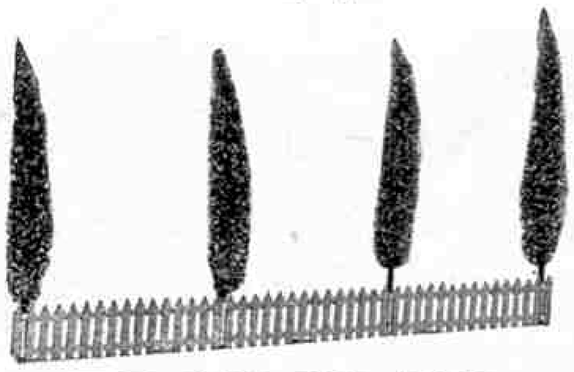
No. 1 The Flying Scotsman.
No. 2 The Scarborough Flier.
No. 3 The Royal Scot.
No. 4 The Merseyside Express.
No. 5 The Golden Arrow.
No. 6 The Bournemouth Belle.
No. 7 Cornish Riviera Express.
No. 8 Torbay Limited Express.
No. 9 King's Cross, York and Edinburgh.
No. 10 King's Cross, Edinburgh and Aberdeen.
No. 11 London (Euston) and Liverpool (Lime Street).
No. 12 London (Euston) and Glasgow (Central).
No. 13 Victoria and Dover.
No. 14 Waterloo, Salisbury and Exeter.
No. 15 Paddington, Exeter and Plymouth.
No. 16 Paddington and Bristol.

Price per packet of four of a kind, **4d.**

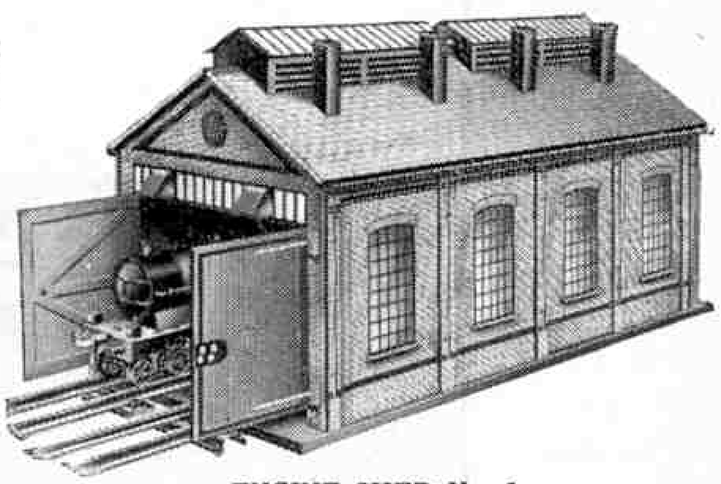
CLIPS FOR TRAIN NAME BOARDS
These clips are for use with coaches that are not fitted with brackets to take the Name Boards. There are two types: No. 2S, for No. 2 Special Pullman and No. 2 Special Pullman Composite Coaches; and No. 2, for No. 2 Pullman and No. 2 Saloon Coaches. Price per packet of twelve, **1/-** (either kind).

LAMP STANDARD No. 2
(Double)
Price **4/6**

MODELLED MINIATURES No. 4 ENGINEERING STAFF
This set comprises six figures representing Electrician, two Fitters, Storekeeper, Greaser and Engine Room Attendant.
Price **2/-** per set.



FENCE WITH FOUR TREES
This is the well-known Paled Fence, provided with four detachable miniature trees fixed in special sockets.
Price, per pair **2/6**



ENGINE SHED No. 1
This Shed will accommodate Locomotives of the M Series, No. 0 and No. 1 types. Price **15/-**

ENGINE SHED No. 2
(as illustrated)
This Shed will accommodate any of the Hornby Locomotives and Tenders. Price **22/6**

MODELLED MINIATURES No. 3 PASSENGERS
This set contains figures as illustrated, representing various types of railway passengers. Price **2/-** per set.

HORNBY ACCESSORIES FITTED FOR ELECTRIC LIGHTING. The following Hornby Accessories will in future be available suitably wired and fitted for electric lighting. These items are additional to the ordinary range.

Engine Shed No. E1E, Electrical	...	Price	**18/6**
Engine Shed No. E2E, Electrical	...	,,	**26/-**
Station No. 2E	...	,,	**12/6**
Island Platform E	...	,,	**9/-**
Goods Platform E	...	,,	**15/-**
Signal Cabin No. 2E	...	,,	**5/6**
Signal No. 2E	...	,,	**4/6**
Double Arm Signal No. 2E ...	...	,,	**6/6**

Junction Signal E		Price	**10/-**
Signal Gantry E		,,	**18/-**
Level Crossing No. E1E, Electrical	...	,,	**7/-**
Level Crossing No. E2E, Electrical	...	,,	**11/-**
Buffer Stops No. 1E		,,	**2/-**
Buffer Stops No. 2E		,,	**7/-**
Water Tank E		,,	**10/-**

In order to facilitate the electrical connection of the above range of accessories, we have introduced a series of flexible leads, fitted with plugs at one end and sockets that fit the accessories at the other. These leads are available in 3 lengths:—9 in., 18 in., and 36 in.—prices—**1/4, 1/5, 1/6** respectively.

We have also introduced a special Distribution Box to enable two or more accessories to be lighted simultaneously. This appliance is fitted with a pair of plugs, for connection to the transformer or accumulator, and also with five pairs of sockets to accommodate the flexible leads described above. Price of Distribution Box **2/6.**

Suggested Hornby Train Improvements

WATER TANKS AND THEIR USES

An important matter in connection with the daily running of every steam locomotive is the replenishment of the water supply so as to enable the rostered work to be performed without any delay owing to the tanks or the tender running short. Provision is therefore made at the sheds and stations for engines to take water while standing, and considerable use is also made of troughs placed between the rails so that by means of a suitable scoop a supply may be taken up on the run. At the sheds storage tanks or stand-pipes, or both, may be used. In goods yards the tank pattern is more often seen, but in stations, where the column may be mounted on the platform, the stand-pipe or water "crane" is usually employed.

For miniature purposes the tank is the more effective pattern, and an excellent example is included in the Hornby Series. In order to make it generally suitable, the type selected is that of a large circular tank mounted on a massive column, instead of the rectangular tank supported by brickwork that is often seen. The tank itself is mounted on a tapered column as in actual practice. A tube of flexible rubber represents the leather "bag" used in the original to conduct the water to the filler of the locomotive. A spring-controlled valve operated by a lever and chain is provided, and a final realistic touch is given by the inspection ladder leading up to the tank. and the drain cup that accommodates the loose end of the tube when this is not in use.

The colouring of this accessory is attractive, the yellow used on the tank being reminiscent of the practice of the L.M.S.R., following the former Midland. The idea of this is to enable the tanks and columns to be easily sighted by enginemen, and when freshly put on it looks quite smart.

The placing of these accessories on a layout is most important. An obvious situation is by the engine shed, and one should be found in a goods or marshalling yard that handles much traffic and so necessitates the employment of a shunting engine more or less constantly. They should also be placed at certain stations—the more important ones at all events, where the engine shed may not be situated very close—and on the line set aside for locomotives at any junction where engine-changing is carried out.

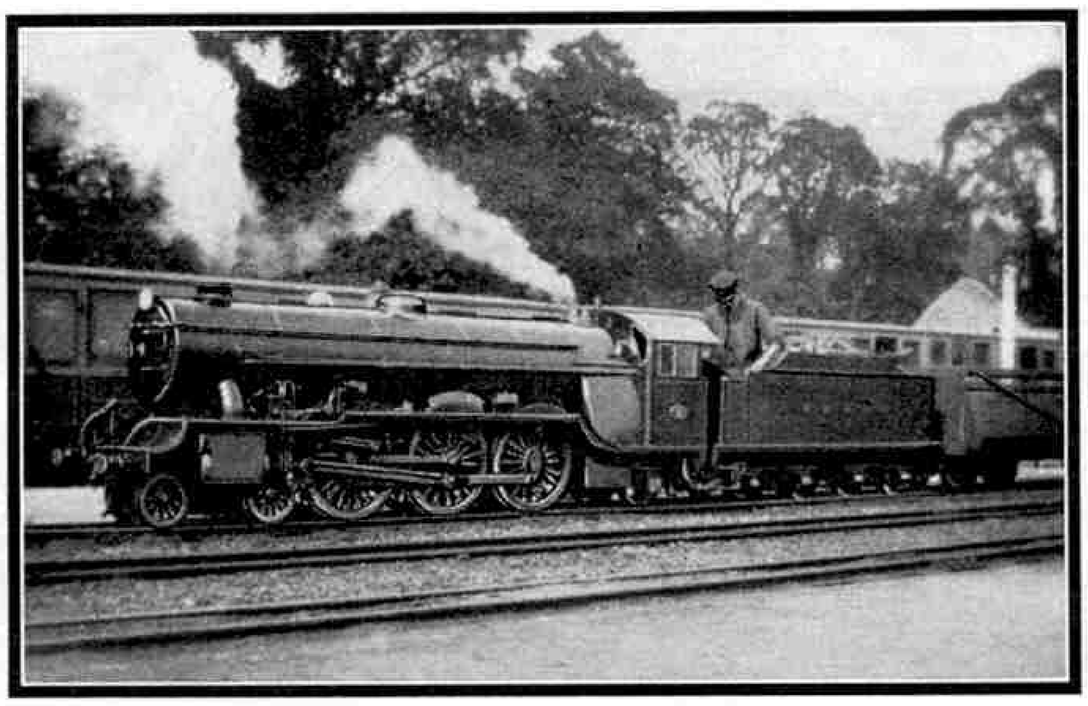
TRACK CIRCUITS ON HORNBY LAYOUTS

The safety of British railways is proverbial, and the development of the signalling system over the course of years is one of the chief reasons for this happy state of affairs. Much depends on the ability of the man in the signal-box, as a mistake by him might result in a serious disaster; and in order to avoid any possibility of mistakes numerous safety devices are installed. One of these safety measures is the provision of track circuiting to indicate in the box the presence of a train in the section so arranged. An engine standing in a siding, or in a terminal platform road, might be overlooked by the signalman unless some special means were adopted to remind him of its presence; and on the main line there is always the problem of trains drawn up to the "home" signal at danger and waiting to proceed. In order to avoid danger from such sources the rails of the sections involved are connected to a battery so that when a train comes into the section its wheels and axles complete the circuit; and this has the effect of giving a visible or audible indication in the signal cabin.

Although mishaps on Hornby railways do not have fatal consequences, they can be very damaging in their results to rolling stock. For this reason, therefore, as much as for its interest, a system of track circuits is an advantage for operating a light or bell in the signal cabin or point from which the line is controlled. If successive sections are track circuited and the lamps or bells grouped together, the movements of the train may be traced for each section by a different bell or differently coloured lamp.

Track circuit schemes have been described in the "*M.M.*" previously, but these have all involved the insulation of the running rails from one another, which meant that one of them had to be lifted from the sleepers and then replaced in its "chairs" with insulating material. An improvement is to use electric rails, which may be converted from clockwork for the purpose by the use of Hornby Centre Rails, Clips and Insulators. The Centre Rail thus reproduces more or less the ramp placed between the rails in the G.W.R. automatic signalling system. The method of operation differs from that of the G.W.R., however, in making use of a collector placed underneath the tender, as it is easier to locate there than on the engine with its bogie and brake and reverse trips. The contact on the tender is arranged so that when it passes over the electric rail the circuit between the centre and running rails is completed. The collector is made of a piece of thin brass or tinplate 4¼ in. long. One end may be wrapped round the leading axle of the tender, extending between the wheels but leaving enough clearance for the axle to run freely. The other portion of the collector may narrow down to about ½ in. or ⅜ in., and is shaped so that it passes below the centre axle to rail level, where it is bent slightly upward, making its end about ¼ in. clear of rail level. The end of the collector is then soldered to a light compression spring, which in turn is fixed to the underneath of the tender. This holds the collector in position, and also allows it to ride smoothly over the Centre Rails when it comes into contact with them. The collector is prevented from moving across the axle by the width of the metal between the wheels.

The lamp used to show that the section is occupied is wired up in the following manner. A Terminal Connecting Plate is used to effect the connection with the running and centre rails, and a wire is led from one terminal of the Plate to the side of the lamp. The base of the lamp is connected to one terminal of a flash-lamp battery. Another wire is then taken from the other battery terminal to the Connecting Plate, so that when the collector on the tender comes in contact with the centre rail it is electrically connected with the running rail and so completes the circuit. As a result the lamp is lit up and indicates that the section is occupied. Readers who adopt this scheme will find it both useful and interesting.



This photograph by A. W. Butterworth of Huddersfield, shows one of the "Pacific" express locomotives of the 15 in. gauge Romney Hythe and Dymchurch Railway. These fine miniature locomotives closely resemble in design the well-known "Gresley Pacifics" of the L.N.E.R.

THE HORNBY No. 1 ELECTRIC TANK

The degree of control of the locomotive afforded is one of the chief causes of the rapidly-growing interest in miniature electric railways. Many owners of electric layouts prefer the convenience of operating their trains from the mains supply through a Transformer, but this method is only possible where the supply is alternating current. The only other practicable source of power is an accumulator, and all H.R.C. members are acquainted with the Meccano Accumulator, which has been specially developed for the purpose.

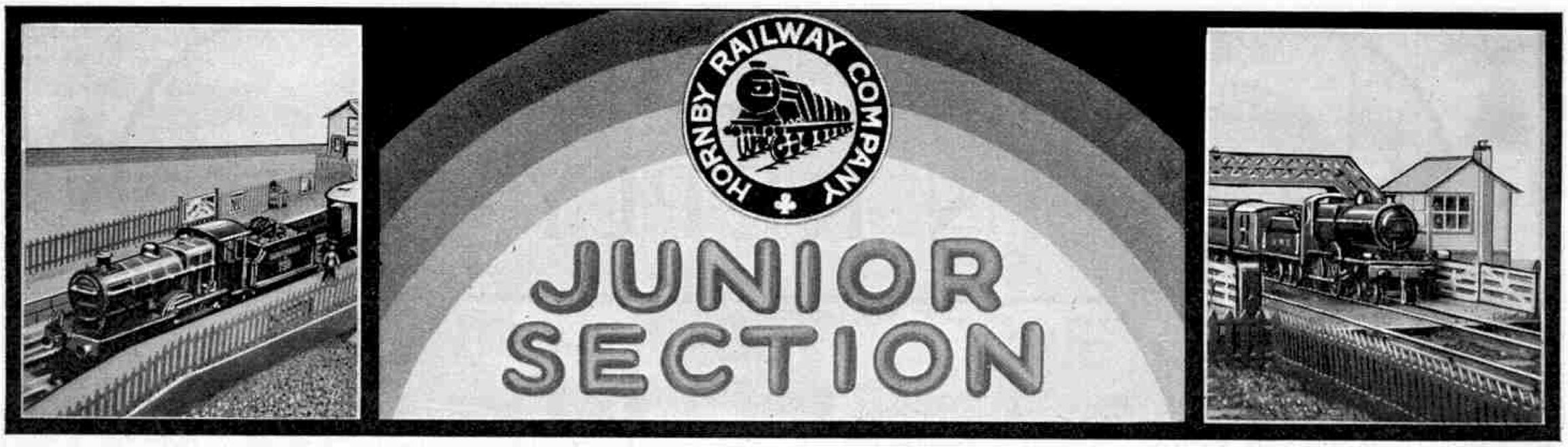
With one exception all Hornby Electric Locomotives are capable of being operated either from an accumulator or by means of a Transformer. The exception is the No. 1 Electric Tank Locomotive, which can only be run from an accumulator. This engine is fitted with a permanent magnet motor, the particular feature of which is that the changing of the direction of the current passing through the motor reverses the engine. Complete control is therefore afforded for starting, stopping and reversing the locomotive and its train, and this is a particularly useful feature. Reversing of the other electric locomotives of the Series is effected by means of a lever in the cab, and the avoidance of this feature makes for a splendid degree of realism. This permanent magnet No. 1 Electric Tank Locomotive requires a special controller, known as the Speed and Reverse Control Switch. One lever of this regulates the speed at which the locomotive travels, and the other effects the reversal of the current and so of the locomotive.

ELECTRIC POINTS FITTED FOR CONTROL.—We have received numerous letters recently asking why we do not manufacture electric points that can be operated from the Lever Frame. Readers will be pleased to hear that these points are obtainable, although they are not listed in our catalogues. They may be obtained through any Hornby Train dealer by placing a special order with him, or they may be purchased direct from this office, in which case postage is extra. There is no additional charge for points thus fitted. (*Reply to J. Swanson, London, S.W.17.*)

LARGER RANGE OF SIGNALS.—The signals at present included in the Hornby Series are sufficient to signal correctly the majority of Hornby Train layouts. We agree that when layouts expand they often become intricate and require the use of signals of more varied and complicated types, but we doubt whether many Hornby Railway owners really desire an increased selection in the matter of signals. (*Reply to E. P. Thornton, Bristol.*)

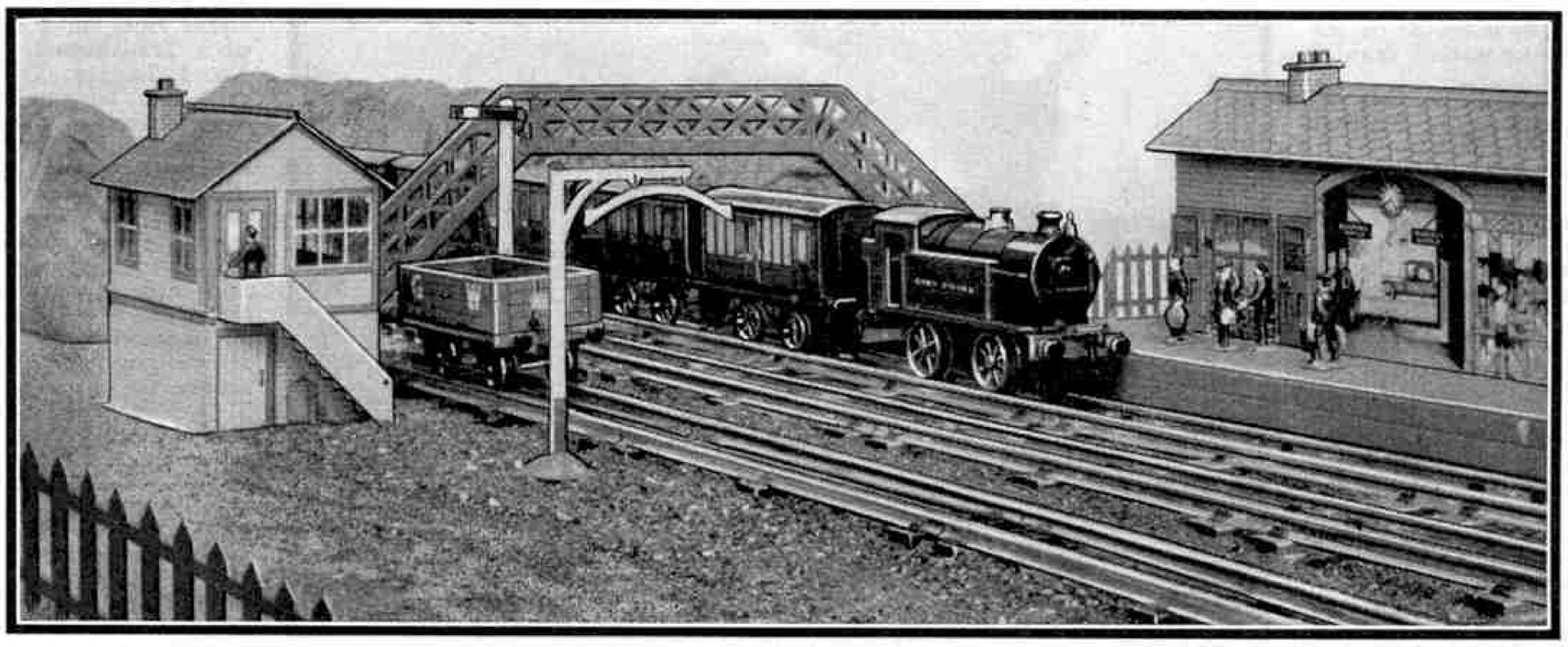
HORNBY L.N.E.R. "HUNT" LOCOMOTIVES.—We are interested in your suggestion that these new L.N.E.R. engines should form the prototype of our L.N.E.R. No. 2 Special Locomotives. The Lentz rotary cam gear of these and two of the older "Shires" is less elaborate than Walschaerts valve motion, but we cannot undertake to reproduce such minute details in Gauge 0, for such small working parts are very fragile. There would be no great advantage in renaming our present "Yorkshire," as the engines, both real and model, have become familiar under that name. We are afraid, therefore, that we cannot undertake to adopt your idea. (*Reply to T. Greenhalgh, Bolton.*)

SLIP COACH APPARATUS.—The practice of slipping coaches is not so widely used as formerly, and is therefore not familiar to many H.R.C. enthusiasts. Most boys prefer to adapt existing couplings to suit slipping systems of their own, and no doubt your own ingenuity will enable you to solve the problem. (*Reply to C. B. Ashton, Bath.*)



XLV.—THE WORKING OF SUBURBAN SERVICES

AS we have frequently stated in these pages, the aim of every miniature railway owner should be the reproduction on his own layout of the actual conditions that obtain in real practice. The extent to which success is attained depends upon a number of factors and, owing to one or other of these, it may be necessary in some cases to modify the original scope of the line. One of the chief of these considerations is the amount of space that is available for the layout, and this has more influence on the final arrangement and working of the miniature system than appears at first. Space not only governs the actual extent of the line, but affects the radius of curve that can be used; and this in turn governs the choice of the rolling stock that can be run. In a limited space, therefore, small radius curves may be imperative, and in these circumstances only the smaller locomotives and items of rolling stock can be operated with success.



A local train entering a suburban station. The Hornby No. 1 Coaches are arranged as a "set train" and the locomotive is one of the familiar M3 Tanks which have remarkable hauling power and length of run.

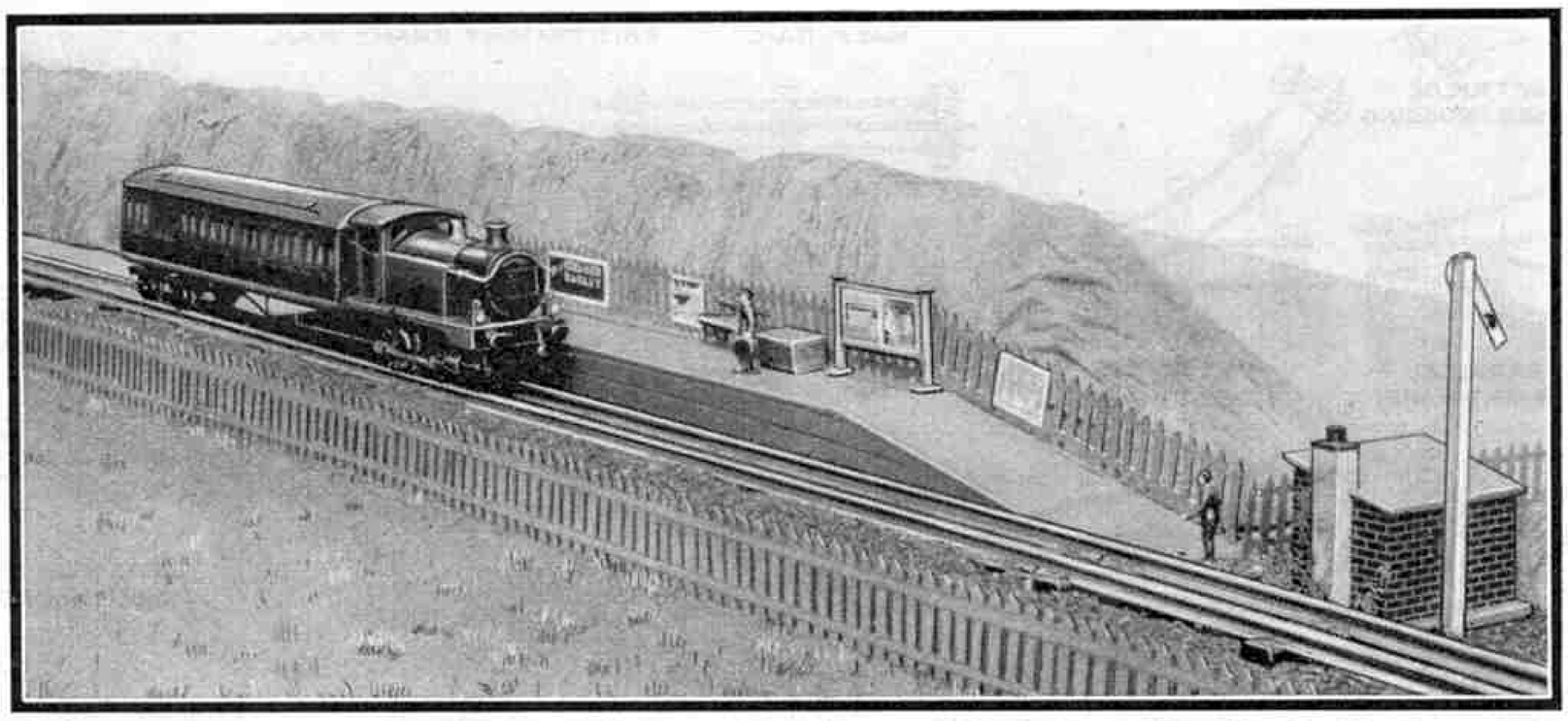
The original scheme of the model railway engineer may have to be modified and, as manager of the line as well, he may have to forgo the idea of running important long-distance expresses that reproduce on a small scale the features of the real "*Royal Scot*" or "*Flying Scotsman.*" This may be necessitated not only by the impossibility of laying down a suitable length of main line, but also by the fact that terminal and junction stations of varying sizes cannot be accommodated in the limited space at his disposal. He will have to be content, therefore, with running less ambitious services. He need not be downhearted about this, however, for much fun is to be had by the correct reproduction of the less spectacular trains of actual practice when the features of the line are in keeping with the services operated.

Goods traffic naturally has its claims, and a good deal of attention has been given in the "*M.M.*" to the layout and working of goods yards and stations, to the make-up of the trains, and to the provision of suitable loads for the wagons employed, according to the district supposed to be served by the line. We propose therefore to devote this article to a consideration of the more ordinary trains operated in the passenger service, which are as useful to the people who travel by them as to the companies who run them for the revenue they produce. We refer particularly to suburban trains. These may appear too familiar to us, possibly by reason of daily travel in them, but they offer interesting possibilities when we come to reproduce the features of their working on our miniature railways.

First of all let us consider the necessary layouts. These depend of course on the type of trains to be run, and the equipment in general may be simple enough provided that there is sufficient accommodation at the main stations, especially where these are of the terminal pattern in a non-continuous layout. Facilities for allowing the engines to run round their trains on arrival should be available if possible, but where space is limited there may not be room for the necessary points or crossovers. In that case the scheme of employing a fresh locomotive for the return journey will suggest itself, the name "turnover" locomotive being applied to the engine that takes up the duty in this manner. As tank locomotives will be employed, no turntable will be necessary, which is a considerable advantage, as these accessories take up a good deal of space. Tank engines of course may be run equally well backward as forward, and in addition they occupy less space than a corresponding tender engine. Wayside stations and other features may be of simple character according to the extent of the system and the resources of the company.

Taking the simple types of trains first, these may be made up of Hornby No. 1 Passenger Coaches, and as they run in each direction with little or no re-marshalling, a passenger Guard's Van should be used at either end if sufficient vehicles can be mustered. An interesting

scheme in connection with these vehicles will be to form them into set trains for the various services, a definite number of coaches composing each train which, for convenience in arranging working timetables and for reference generally, should be given a letter or a number, or possibly a particular name. The scheme recently proposed on the "*In Reply*" page may be taken advantage of in such circumstances and the coaches arranged as close-coupled sets. These are very useful for intensive suburban services, as they are operated as complete units and require no making up in the sidings once the permanent coupling up has been arranged. Extra vehicles may of course be added during particularly busy periods, or possibly two sets may be combined to form one train. One or two units of two or three coaches may be kept in reserve for such duties and be labelled "strengthening sets," after the custom of real practice.



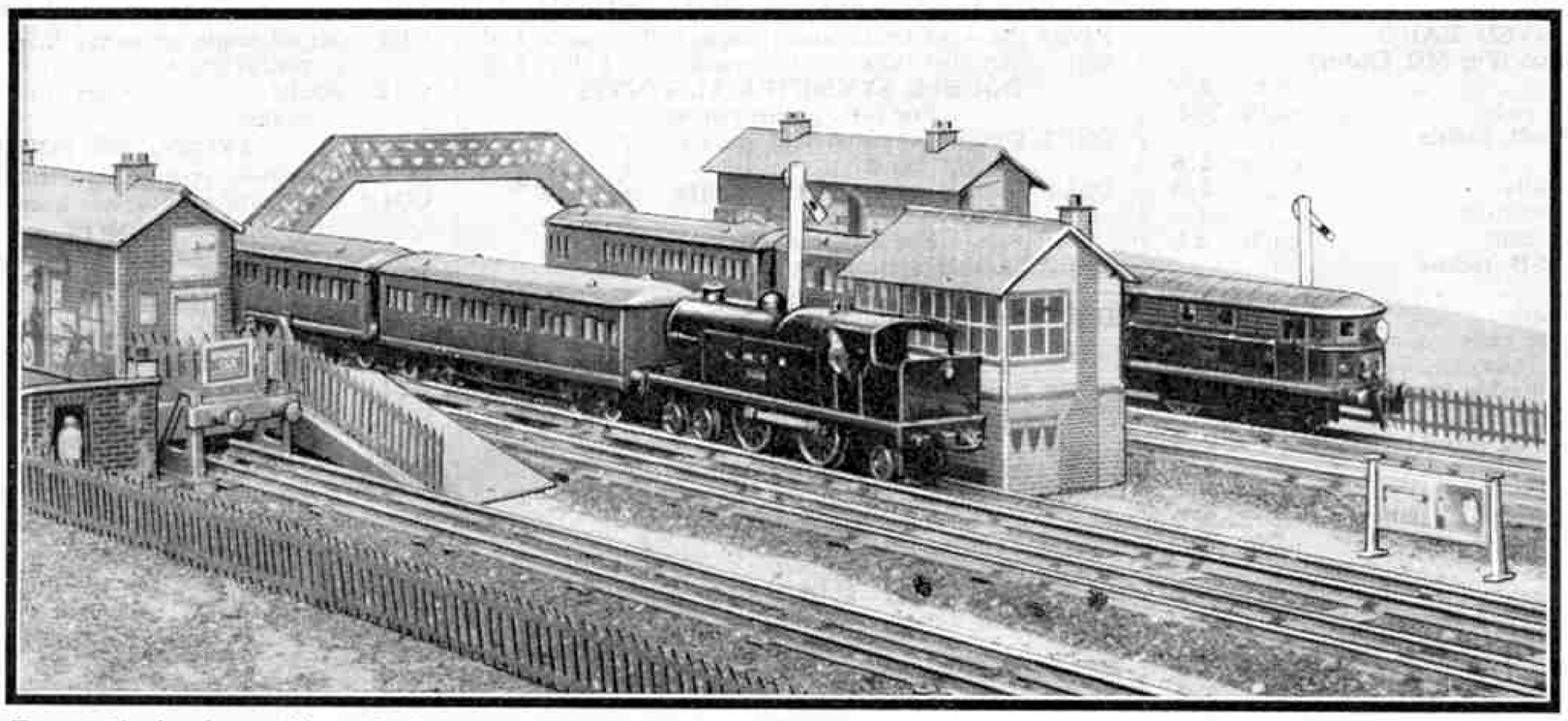
A simple wayside station or "halt." The line is served by a rail motor made up of an old No. 1 Tank and a Metropolitan Coach as suggested in this article.

For such trains as these a suitable type of locomotive is the Hornby M3 Tank. These little engines are simple in external design, as are most small tank engines engaged in suburban work; and like them they have quite remarkable power for their size and a very good length of run. The latter quality may not appear very important for short-distance stopping trains, but it enables the operator to run the engine for a complete trip, including several stops, without having to rewind the motor. Reversing gear is of course provided, as is necessary on a tank engine that requires to work equally well in the forward and in the backward direction.

More elaborate in general style is the Hornby No. 1 Tank Locomotive, for this has outside cylinders. It therefore imitates satisfactorily many of the tank engines of more up-to-date design, but still of moderate dimensions, that are now running. A useful feature is that the reversing gear may be operated from the track as well as by means of the lever in the cab. This allows us to manœuvre the engine in a satisfactory manner by means of Brake and Reverse Rails that may be placed where required in the various stations and sidings.

To supplement the services operated by such trains, or to replace them during periods when little traffic is to be handled, a motor train may be employed, formed of an engine with perhaps only a single coach, the latter being pulled in one direction and pushed in another. More interesting still will be the use of a rail motor, where the engine and coach are combined as one. The method of making up such a unit was described in the "*In Reply*" page of the "*M.M.*" last June, and numerous model railway owners have followed up the scheme with success. Useful employment is found in this manner for a small tank engine that may be of an obsolete pattern and perhaps is now of insufficient power to take its place in a "link" with later engines on suburban duties.

For connecting services, too, on branch lines a rail motor is very useful. The station equipment of a branch may be of the simplest character, and there is a considerable advantage in the use of a motor train or a rail motor, for neither of them requires running-round facilities at terminal points. The simple nature of branch stations suggests a further possibility that we may make use of on the main line itself. This is to provide a platform or "halt" in between two recognised main stations. Not all trains may be booked to call there, and in fact the omission of stops at different main stations by different trains will be quite in order, as this is frequently a feature of actual suburban services. This applies of course to the regular trains and not to rail motors, for these, by calling at small stopping places, afford a useful service and are able to pick up any traffic that may be obtained. Such halts are often found in actual practice, and are frequently provided in districts that are developing between existing stations. They enable the railways to offer a service for passenger, and perhaps light goods traffic, that otherwise might go by road.



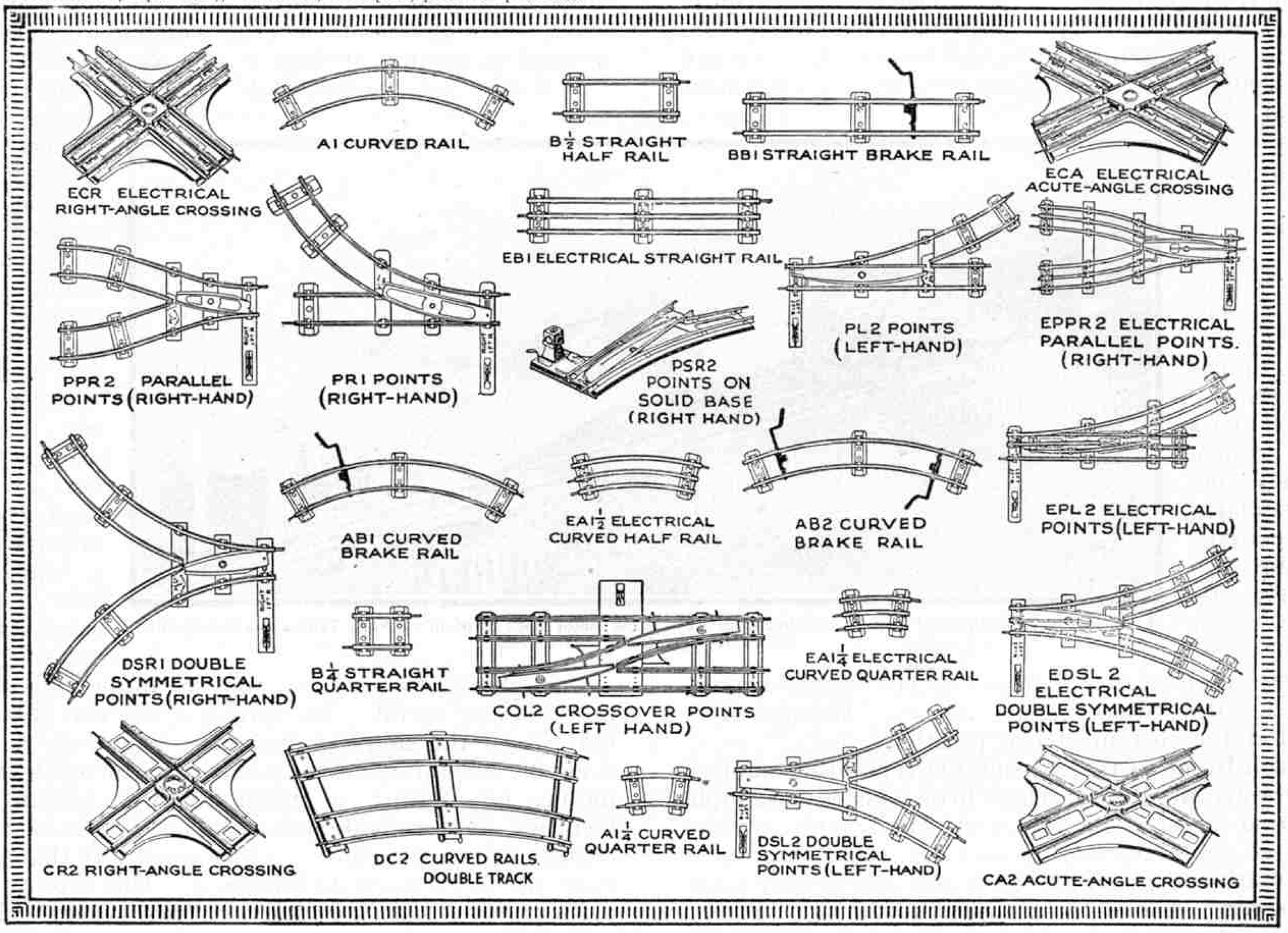
Two methods of operating suburban traffic appear in this photograph. A Metropolitan Electric Train is leaving the station while a No. 2 Tank passes through with a semi-fast train.

For longer distance, or what we may term "residential" traffic, more elaborate provision must be made, for such trains run very smartly between

(*Continued on page 729*)

Hornby Series -:- Rails, Points and Crossings -:- Hornby Series

Hornby Rails, Points and Crossings are designed to meet the most exacting requirements of model railway enthusiasts. The variety of Points, left-hand and right-hand turnout, together with the Crossings, make possible an almost endless number of realistic and railway-like layouts. The adaptability of the Rails, Points and Crossings is well shown in a special booklet "How to Plan your Hornby Railway," which is obtainable from your dealer, price 3d., or from Meccano Limited (Dept. A.B.), Old Swan, Liverpool, price 4d. post free.



Alternate Pegs

	CURVED RAILS		
	9-in. radius (For MO Trains)		
M9	Curved rails	doz.	3/–
MB9	Curved brake rails	each	3½d.
	1-ft. radius		
A1	Curved rails	per doz.	4/6
A1½	Curved half rails	„	3/6
A1¼	Curved quarter rails	„	3/–
AB1	Curved brake rails	each	6d.
	2-ft. radius		
A2	Curved rails	per doz.	4/6
A2½	Curved half rails	„	3/6
A2¼	Curved quarter rails	„	3/–
AB2	Curved brake rails	each	6d.
DC2	Curved rails, double track ...	½ doz.	7/6
	STRAIGHT RAILS		
BM	Straight rails (for MO Trains)	per doz.	2/9
B1	Straight rails	„	4/–
B½	Straight half rails	„	3/–
B¼	Straight quarter rails	„	2/6
BB1	Straight brake rails	each	5d.

Rails for Clockwork and Steam Trains

Gauge 0, 1¼"

BBR1	Straight brake and reverse rails	each	1/6
DS1	Straight rails, double track ...	½ doz.	6/6
	DOUBLE SYMMETRICAL POINTS		
	For 1-ft. radius curves		
DSR1	Double symmetrical points, right-hand	per pair	5/–
DSL1	Double symmetrical points, left-hand		
	For 2-ft. radius curves		
DSR2	Double symmetrical points, right-hand	per pair	5/–
DSL2	Double symmetrical points, left-hand		
	PARALLEL POINTS		
PPR2	Parallel points, right-hand	per pair	5/–
PPL2	Parallel points, left-hand		
	CROSSINGS		
CA1	Acute-angle crossings (for 1-ft. radius tracks)	each	2/–
CA2	Acute-angle crossings (for 2-ft. radius tracks)	„	1/9
CR1	Right-angle crossings (for 1-ft. radius tracks)	each	2/–
CR2	Right-angle crossings (for 2-ft. radius tracks)	„	1/9
	CROSSOVER POINTS		
COR2	Crossover points, right-hand	per pair	12/–
COL2	Crossover points, left-hand		
	POINTS		
	9-in. radius (For MO Trains)		
MR9	Right-hand points	per pair	3/–
ML9	Left-hand points		
	1-ft. radius		
PR1	Right-hand points	per pair	4/–
PL1	Left-hand points		
	2-ft. radius		
PR2	Right-hand points	per pair	4/–
PL2	Left-hand points		
PSR2	Points on solid base, right-hand	per pair	8/6
PSL2	Points on solid base, left-hand		
RCP	Rail connecting plates ...	½ doz.	2d.

Rails for Electric Trains

	CURVED RAILS		
	1-ft. radius		
EA1	Curved rails	per doz.	6/6
EA1½	Curved half rails	„	4/6
EA1¼	Curved quarter rails	„	4/–
	2-ft. radius		
EA2	Curved rails	per doz.	6/6
EA2½	Curved half rails	„	4/6
EA2¼	Curved quarter rails	„	4/–
EDC2	Curved rails, double track ...	½ doz.	9/–
	STRAIGHT RAILS		
EB1	Straight rails	per doz.	6/–
EB½	Straight half rails	„	4/6
EB¼	Straight quarter rails	„	4/–
EDS1	Straight rails, double track ...	½ doz.	8/6
	CROSSINGS		
ECA	Acute-angle crossings ...	each	4/–
ECR	Right-angle crossings	„	4/–
	POINTS		
	For 2-ft. radius curves		
EPR2	Right-hand points	per pair	7/6
EPL2	Left-hand points		
	DOUBLE SYMMETRICAL POINTS		
	For 2-ft. radius curves		
EDSR2	Double symmetrical points, right-hand	per pair	8/6
EDSL2	Double symmetrical points, left-hand		
	PARALLEL POINTS		
	For 2-ft. radius curves		
EPPR2	Parallel points, right-hand...	per pair	8/6
EPPL2	Parallel points, left-hand ...		
	CROSSOVER POINTS		
ECOR2	Crossover points, right-hand	per pair	24/–
ECOL2	Crossover points, left-hand		
TCPL	Terminal connecting plates (low voltage)	each	1/6

Electrical Points for 1-ft. radius curves are not supplied.

Centre Rails for Converting Ordinary Track to Electrical

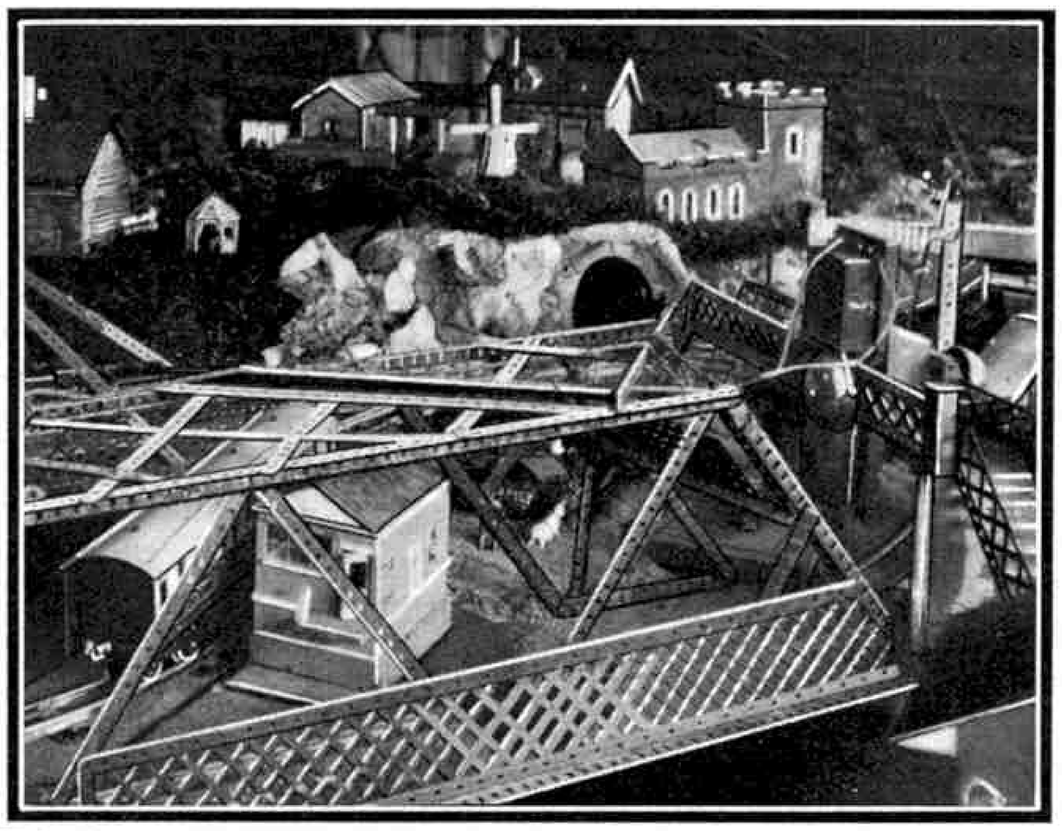
	CURVED CENTRE RAILS		
	1-ft. radius		
AC1	Curved centre rails ...	per doz.	1/–
AC1½	Curved centre half rails ...	„	9d.
AC1¼	Curved centre quarter rails ...	„	6d.
	2-ft. radius		
AC2	Curved centre rails ...	per doz.	1/–
AC2½	Curved centre half rails ...	„	9d.
AC2¼	Curved centre quarter rails ...	„	6d.
	STRAIGHT CENTRE RAILS		
BC1	Straight centre rails ...	per doz.	1/–
BC½	Straight centre half rails ...	per doz.	9d.
BC¼	Straight centre quarter rails ...	„	6d.
ICR	Insulators for insulating centre rails	per doz.	3d.
CCR	Clips for fixing centre rails ...	„	6d.

Manufactured by MECCANO LIMITED, OLD SWAN, LIVERPOOL

Two Interesting Model Railways

WE have recently received from Mr. H. A. Frere, of Roydon Hall, Diss, Norfolk, a description of a miniature railway of unusual interest that he has constructed for his 10-year old son.

The railway was commenced above five years ago, and since then has constantly been extended and improved. It is housed in a room measuring 24 ft. 6 in. by 23 ft., which it fills almost completely. It is built in the form of a square, with a track running down the centre, and there is a passage-way round three of its sides. The chief engineering feature of the layout is a model of the Forth Bridge built entirely of Meccano. This bridge, of which, owing to lack of space, only two of the three cantilevers could be erected, is 18 ft. in length, and each of the cantilevers is 4 ft. in height. Other prominent features of the layout are a tunnel 12 ft. 5 in. in length, accommodating three tracks; an engine shed and a turntable; three passenger stations and a goods station; three bridges, in addition to the Forth Bridge; a railway cutting, a viaduct and a small tunnel.



This photograph shows the extensive use of Meccano on the railway layout of Mr. H. A. Frere, of Royden Hall, Diss, Norfolk. A bell operated electrically by the trains themselves as they leave the tunnel mouth can be seen by the footbridge on the right.

There are altogether four tracks, namely, the Outer Track, the Inner Track, a Suburban Track, and a Sub-Suburban Track. The total length of the four tracks is 201 ft. The Suburban and Sub-Suburban Tracks make use of the Inner Track across the Forth Bridge to complete their circuits. There are four sidings with a total length of 47 ft. The tracks are ballasted with gravel and earth.

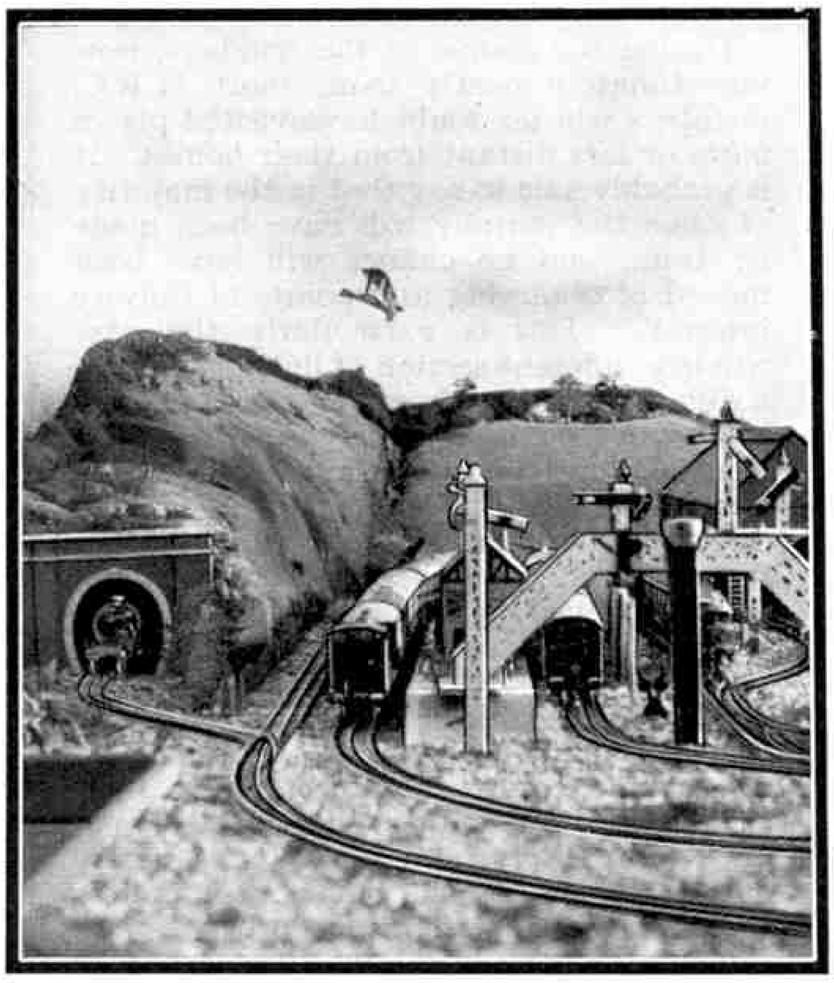
The interest of the layout is greatly increased by an elaborate scheme of scenic accessories, including a church, a farmyard, a windmill, livestock of various kinds, and fields, trees and hedges. An interesting feature is a bell connected to an electric battery in the tunnel that announces automatically the arrival of trains as they leave the tunnel mouth.

The locomotive equipment includes all the Hornby engines and others of various makes, and practically every item of rolling stock in the Hornby System. It is interesting to note that the Hornby G.W.R. "*County of Bedford*" is easily the fastest locomotive.

Another attractive system is that of Mr. W. G. Lilly of Wallington (H.R.C. No. 2390), and it is known as the London, Norwich and Ely Railway. The whole railway is raised to a convenient height on tables, and electricity is employed as the motive power. The continuous main line has two tracks through-out, one complete circuit being about 38 ft. in circumference. There are several sidings, and the whole track is divided up into sections so that two electric locomotives may be operated independently of one another.

In all there are four stations of varying sizes at different points on the lay-out. The most important of these is a three-road terminus covered by a glass roof, the other three being a combined terminal and through station, and two passing stations, one large and the other of the smaller wayside type. The railway is effectively illuminated by means of small lamps taking their current through transformers from the mains supply.

Considerable attention has been given to scenic effects and excellent results have been obtained, as can be seen in the lower illustration on this page. An interesting point is the presence of aircraft in the sky portions of the scenery, which gives a novel and up-to-date touch to the surroundings. The hills, mountains, and other features have been reproduced by covering rough wooden frameworks with paper, glued and painted. Pieces of moss and stone are fixed in suitable positions, and an effective background for the whole is obtained by the use of sky-blue wallpaper.



Part of the layout of Mr. W. G. Lilly of Wallington. The mouth of the tunnel and the hill through which it passes are very effective, also the aeroplane appearing in the background.

Five Hornby Pullman coaches form the most important train on the system, and these are interesting in that they have been adapted for electric lighting, current being obtained from the third rail. A 2–6–0 tender locomotive or a 4–6–0 tank usually deals with these; and of the other coaches, two make up a set train for a Hornby Metropolitan Engine. Several goods wagons also are in use, and further developments in this direction are expected to take place in the near future.

Most of the accessories such as stations and tunnel mouths have been made at home.

H.R.C. COMPETITION PAGE

Competitions appearing on this page are open only to members of the Hornby Railway Company. Envelopes containing entries should have the title of the competition clearly written in the top left-hand corner and should be addressed to the Hornby Railway Company, Binns Road, Old Swan, Liverpool. The name, address and membership number of each competitor should appear in clear writing on every sheet of paper used.

JUMBLED ACCESSORIES CONTEST

For most H.R.C. members this month sees the commencement of another model railway season, although of course many enthusiasts are unwilling to admit that there is any question of a "season" about it at all, and operate their trains continuously throughout the year. However, more interest is naturally devoted to railway matters in miniature from September onward, and the question of additions and extensions occupies the mind of nearly every H.R.C. member.

With regard to additions, a programme is usually mapped out, but the bigger items such as locomotives and coaches are judiciously left until later on when the gift season may be reasonably expected to fulfil the wants of the "company" in this direction. Extensions may be undertaken, and in any case improvements of the existing portions of the line may be made by the addition of various accessories. Similarly, slight alterations of the original scheme may necessitate the purchase of further equipment of this kind.

Accessories therefore form a subject of immediate interest, and we are taking advantage of this in presenting our competition this month. A list of 12 different items appears in the centre of this page, but with the various letters so jumbled up that any model railway owner might be forgiven his surprise if a friend recommended him to add any particular one to his layout!

TRAWNEKTA
DINNEGESEH
FOSTERBUFP
NARTALPCROFEM
GISBALINCAN
ISTRALYAWONAIT
GLEPROLPEETHA
GINDLENECFAP
CLESSOVRINGLE
PRUTENOLSHES
TRIGLANNYGAS
GOALGUANIDGE

However, we are sure that members will be keen to decide what these cryptic words actually represent, and with some patient work the apparently hopeless jumble will gradually resolve itself into the names of 12 well-known railway accessories of the Hornby Series. When the list has been completed to his satisfaction, the competitor should write out the solution neatly and in the same order that the words appear on this page. The entry must then be forwarded to H.R.C. Headquarters at Meccano Ltd., Binns Road, Old Swan, Liverpool, in an envelope clearly marked in the top left-hand corner "*H.R.C. Accessory Contest.*" If a full list cannot be made up, the partially complete entry should be sent in.

The competition will be divided into the usual two Sections—Home and Overseas. In each four prizes will be awarded. These will consist of Hornby Train goods (or Meccano products if preferred) to the value of 21/–, 15/–, 10/6 and 5/– respectively. A number of consolation prizes will also be given and in the event of a tie neatness and originality in presentation will be taken into account when making a decision. Entries in the Home Section must be posted to reach Headquarters on or before 30th September. The closing date for the Overseas Section is 31st December.

Competitors are reminded that entries not bearing their H.R.C. number will be disqualified.

Essay Contest

We continue to receive many letters saying kind things about the H.R.C. pages of the "*M.M.*," and some of the most appreciative have come from readers who are not members of the Hornby Railway Company. Occasionally criticisms have been received, of course, but coupled with these have been some very helpful suggestions; these we have welcomed, for generally they have enabled us to effect some improvement in the H.R.C. pages.

We believe that there are many other readers who have helpful suggestions, and who are only needing a little encouragement to send them to us. For this reason we have chosen for this H.R.C. Essay Contest the subject: "*How I think the H.R.C. pages of the 'M.M.' could be improved.*" Essays should not exceed 500 words.

The contest will be divided into two sections, A for those of 16 and over, and B for those under 16. Prizes of Hornby Railway Material (or Meccano if preferred) to the value of 15/–, 10/6, 5/– and 2/6 respectively will be awarded for the four most helpful essays in each section.

The competitor's name, address, age and H.R.C. number must be clearly written on the back of every sheet submitted, and envelopes should be marked "H.R.C. Competition Essay" in the top left-hand corner, and forwarded to Meccano Ltd., Binns Road, Old Swan, Liverpool. Closing date, 30th Sept. Overseas, 31st December.

Holiday Drawing Contest

During the course of the holidays, now unfortunately nearly over, most H.R.C. members will no doubt have visited places more or less distant from their homes. It is probably safe to say that in the majority of cases the journey will have been made by train, and no chance will have been missed of observing any points of railway interest. This is particularly the case where a different section of line, or perhaps a different railway from the one that they live near, has been made use of. Apart from locomotives and rolling stock, fittings and appliances of entirely new types will have been observed, and many other features will have been carefully noted by sharp eyed enthusiasts.

This month, therefore, we provide H.R.C. members with an opportunity of demonstrating their keen observation by inviting them to make a drawing of the most interesting feature they saw during their holidays. Any subject may be chosen, and competitors may submit as many entries as they wish, but no competitor may receive more than one prize.

To the senders of the four best drawings Hornby or Meccano goods to the value of 15/–, 10/6, 5/– and 2/6 respectively will be awarded. In addition a number of consolation prizes will be awarded to those boys whose entries show neat and painstaking efforts. Entries should bear the competitor's H.R.C. number and should be enclosed in an envelope clearly marked "H.R.C. Holiday Drawing Contest," and posted to reach Headquarters at Meccano Ltd., Binns Road, Old Swan, Liverpool, on or before 30th September. Overseas closing date, 31st December.

COMPETITION RESULTS

HOME

June "Locomotive Feature Contest."—First: E. V. Woodward (23700), Edgware, Middx. Second: J. B. Sheldon (2311), Four Oaks. Third: S. Howarth (21914), Delph, Nr. Oldham. Fourth: L. Parish (18054), Coventry. Consolation Prizes: K. Kostain (5108), Bolton, Lancs.; C. E. Wrayford (6039), Newton Abbot, Devon; R. Barbary (5580), Mevagissey, Cornwall; J. H. Owen (25954), Radford, Coventry; J. W. C. Lowe (25627), Clacton-on-Sea, Essex; J. H. Saunt (2264), Stoke, Coventry.

June "Summer Photo Contest."—First: E. C. R. Williams (9517), Holyhead. Second: G. M. Lane (11170), Wakefield, Yorks. Third: G. E. Waters (20630), Southall. Fourth: P. H. English (2398), Lancaster. Consolation Prizes: A. R. Holmes (17022), Peterborough; J. F. Hemmings (29782), Hertford; R. Burrell (27679), London, S.W.16.

OVERSEAS

March "Missing Links Contest."—First: H. H. Matthews (24642), N.S.W., Australia. Second: B. Chiles (9191), Port Elizabeth, South Africa. Third: D. J. White (9333), Dunedin, New Zealand. Fourth: R. A. Wragg (7913), Bandikui, India. Consolation Prizes: E. C. Stonyer (10306), New Zealand; W. Fagg (8557), New Zealand; H. C. Key (24764), Calcutta, India; J. H. Neville (23636), W. Australia; W. J. T. Watson (18065), Australia; J. A. Rodriguez (3647), Montreal, Canada; R. B. McMillan (9592), Australia.

March "Station Layout Contest."—First: R. Hondelink (25394), Baarn Holland. Second: G. Spreadborough (27909), Cambridge, C.P., S. Africa. Third: R. S. Robbins (29906), Canada. Fourth: J. Stanbridge (10236), Perth, W. Australia.

Competition Page

"GREATEST THRILL" VOTING CONTEST

Almost every day our newspapers record some new and remarkable exploit, and in reading about it we think what a thrilling experience it must have been. Some of these exploits make us wish we could do the same ourselves, while others do not attract us so much. In order to find out what kind of experiences would give our readers the biggest thrill we have prepared this month a special contest.

In the accompanying panel are listed eight exciting experiences, and competitors are required to do two things—first to state which one would give them the greatest thrill, and then to arrange the list in the order that they think will be the general order of popularity as indicated by the votes of all the competitors.

1. **Motoring at 254 m.p.h.**
2. **Motor-boating at 120 m.p.h.**
3. **Making a Parachute Descent.**
4. **Flying solo across the Atlantic.**
5. **Ascending in a balloon to 10 miles high.**
6. **Climbing Mount Everest.**
7. **Footplate Trip on the "Cheltenham Flyer."**
8. **Diving for Sunken Treasure.**

The list of "adventures" contains nothing of a freakish nature; every one is chosen as something that has already been accomplished or may be considered as likely to be achieved within the course of the next few years. It may be that a Meccano boy who now chooses the conquest of Everest as his greatest thrill, may actually be one of the first expedition to achieve this perilous mountaineering feat.

Meccano products—to be chosen by the winners from the current catalogues—to the value of 21/–, 15/–, 10/6 and 5/– respectively, will be awarded to the senders of the four entries in order of merit that forecast most nearly the order indicated by the massed votes, and in addition there will be a number of consolation prizes. In awarding these, neatness and novelty of presentation will be considered in addition to accuracy.

No competitor may submit more than one entry, which must be addressed "Adventure Voting Contest, Meccano Magazine, Binns Road, Old Swan, Liverpool," and sent to reach this office not later than 30th September. A duplicate set of prizes will be reserved for Overseas readers, whose entries must arrive not later than 31st December.

Competitors in the Home Section should use post cards for their entries. This restriction does not apply to Overseas competitors, as in certain countries post cards are not obtainable.

September Photo Contest

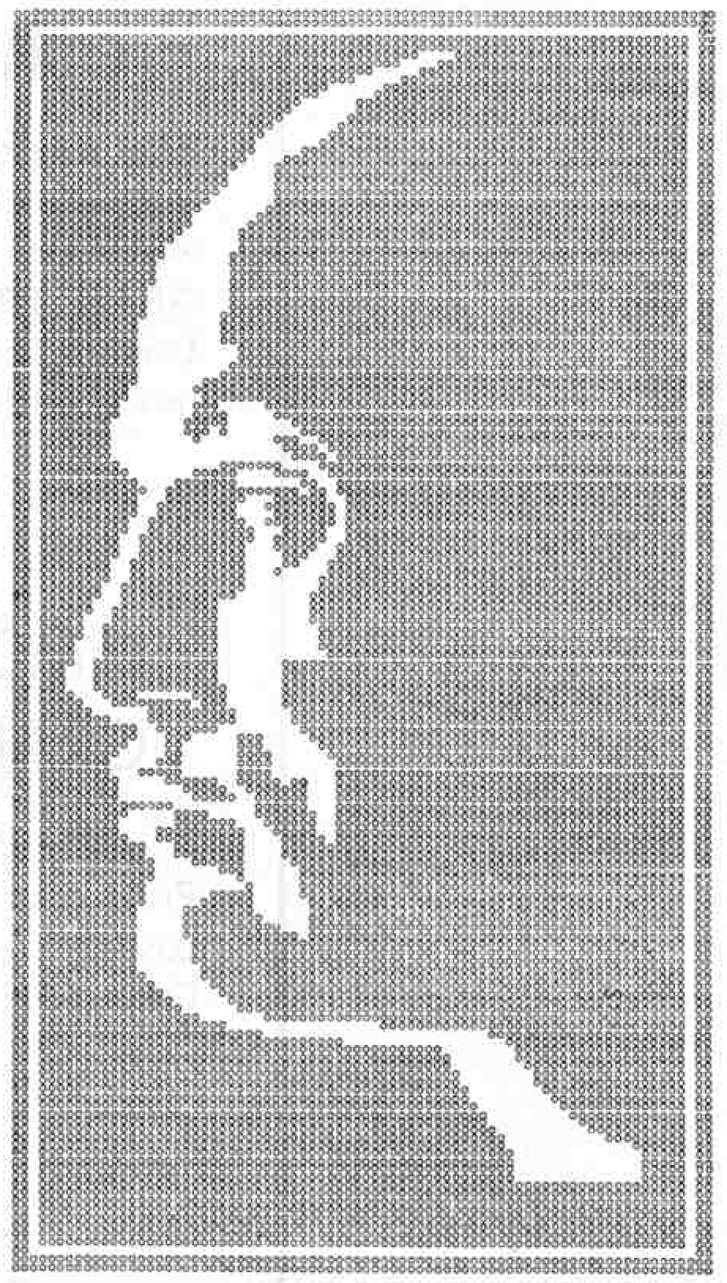
This month's contest is the last of the season, and those readers who have not yet taken part in an "*M.M.*" Photo Contest are urged to take this opportunity. The conditions are so very simple that everyone has a chance of success. Photographs of any subject, made with any camera or any make of film or plate, printed on any paper, and even professionally finished, are eligible. There are only two restrictions—that the exposure shall have been made by the competitor, and that each print must bear a title, in addition to the competitor's name, age and address.

Prizes of Meccano products or photographic materials—as selected by the winners—to the value of 21/– and 10/6 respectively, will be awarded to the senders of the first and second entries, in order of merit, in each of the two sections into which the contest will be divided: A, for entries from competitors aged 16 and over, B for those from readers under 16.

Entries should be addressed to "September Photo Contest, Meccano Magazine, Binns Road, Old Swan, Liverpool," and must reach this office not later than 30th September. Overseas closing date, 31st December.

Competitors should note that it is not sufficient to indicate the age by writing Section A or B on their entries. The actual age must be stated.

It is important to note that unsuccessful entries will be returned if a stamped and addressed cover is sent with the entry for the purpose.



This clever typewriter-drawn portrait of Signor Mussolini secured first prize in the Typewriter Design Competition for Norman Weight, of Whitstable, Kent.

COMPETITION RESULTS

HOME

June Photo Contest.—First Prizes: Section A, W. M. Hunter (Lewisham, S.E.13); Section B, J. MacNaughtan (Kirkcaldy). Second Prizes: Section A, E. D. Morris (Ashtead); Section B, C. Dunhill (Bingley). Consolation Prizes: A. B. Bishop (Bristol); S. Garbutt (Altrincham); J. B. Gibson (East Preston); G. L. Hare (London, S.W.1); S. H. Hiley (Taunton); L. Randles (Wrexham); J. Thorburn (Glasgow); F. G. White (South Darenth).

June Crossword Puzzle.—1. K. H. Sutton (Birmingham); 2. K. Costain (Bolton); 3. W. M. Stone (Hove); 4. D. Gordon (Edinburgh). Consolation Prizes: K. W. Anderson (Anerley, S.E.20); R. Barbary (Mevagissey); W. F. L. Clement (Willington); J. L. Holt (Richmond); G. F. Oldacre (Stoke-on-Trent); H. Rutter (Consett); I. D. M. Simpson (Glasgow); J. A. Wainwright (South Tottenham, N.15); G. A. Wheeler (Stoke Newington, N.16).

Sketchograms.—First Prizes: Section A, C. Spencer (Warsash); Section B, J. A. L. Naughton (Edinburgh). Second Prizes: Section A, F. Sloane (Holloway, N.7); Section B, J. M. Southam (Lowestoft). Consolation Prizes: H. P. Dicken (Wrexham); A. Goad (Eltham, S.E.9); J. Hiatt (Eastbourne); H. R. Hiscott (Ilford); A. E. Lukey (Camden Town, N.W.1); R. McCall (Cork); N. H. Ray (Benton); K. Royle (Marple); W. M. Todd (Aberdeen); A. Warren (Norwich).

OVERSEAS

March Crossword Puzzle.—1. E. Harper (Cambridge, S. Africa); 2. W. S. Eagle (Bombay); 3. G. Whalley (Brockville, Ont.); 4. A. McIver (Satanur, S. India). Consolation Prizes: Miss J. Arcus (Masterton, N.Z.); P. Isaacson (Malta); N. MacLeod (Auckland, N.Z.); J. J. Minnaar (Bellville, S. Africa); Miss M. Morten (Auckland, N.Z.); M. W. Morten (Auckland, N.Z.); D. W. Young (Amatikulu, S. Africa).

Happy Snaps.—Animals Section. First Prizes: Section A, T. Ross (Sydney, N.S.W.); Section B, Th. W. Guenther (Windhoek, S. Africa). Second Prizes: Section A, B. K. Johnson (Toronto); Section B, J. Thomas (Capetown). **Children's Section.** First Prizes: Section A, W. A. P. Smit (Overveen); Section B, F. Manderson (Auckland, N.Z.). Second Prizes: Section A, Miss M. A. Borrow (Grahamstown, S. Africa); Section B, R. Gates (Paris).

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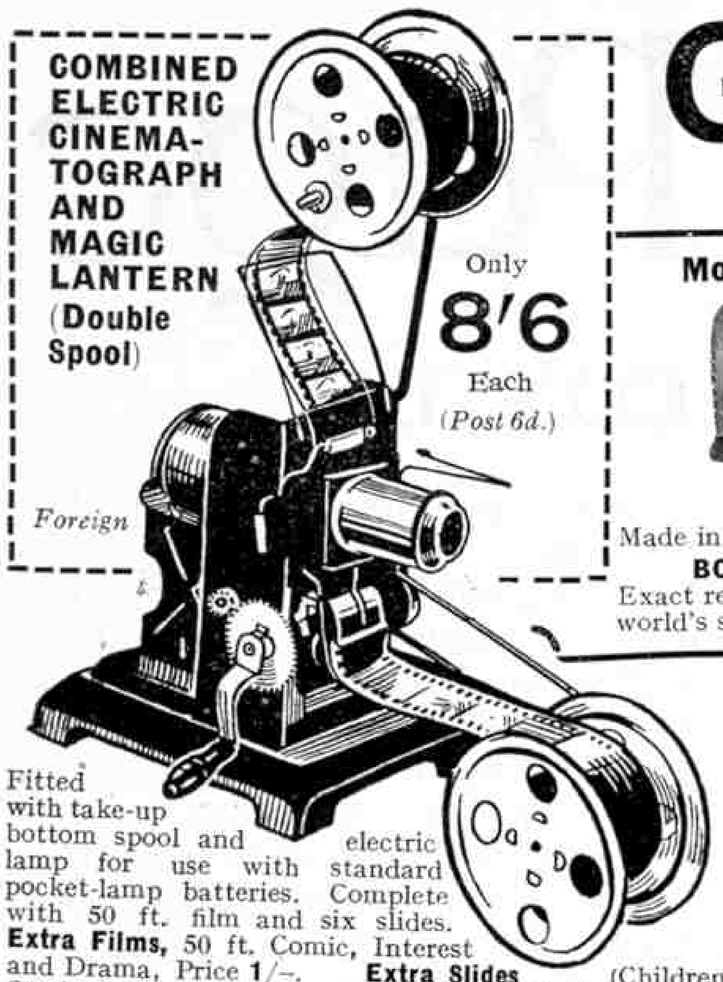

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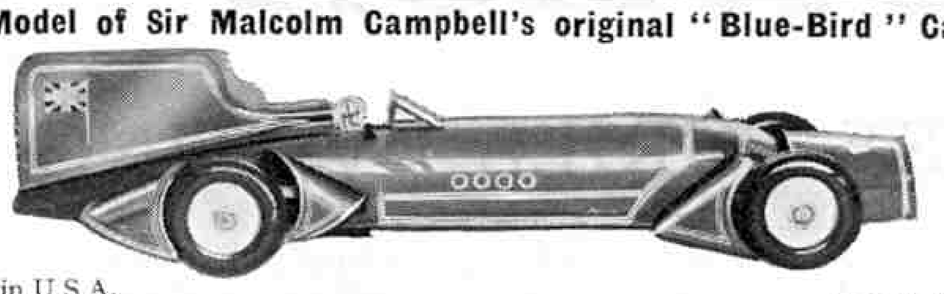

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No. 1 Muzzle Loader. A fine gun for young sportsmen at a very low price. *Foreign.* **4/9** *(Post 9d.)*

Slugs, 9d. 1,000 **Darts, 4½d.** doz.

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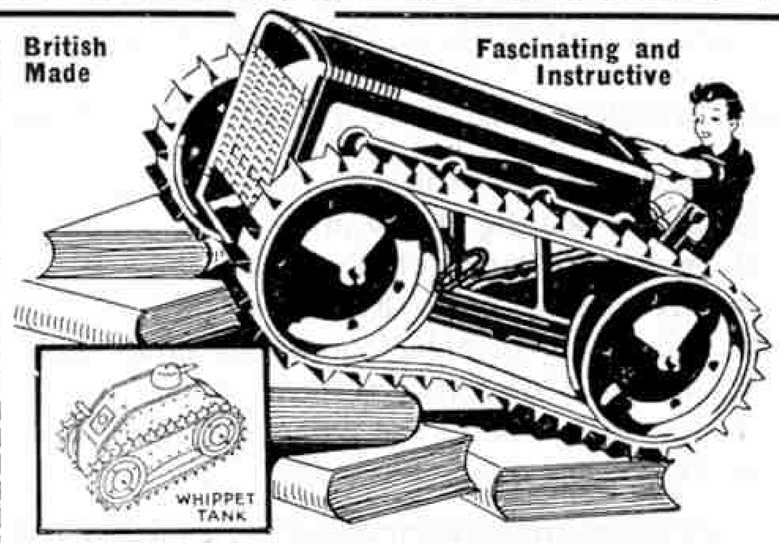
The assortment varies from 20 to 50 stamps according to value. Supplied in the following countries:—Persia, Jugo-Slavia, Fiume, Sweden China, Czecho-Slovakia Turkey, Greece, Saar. Denmark, Hungary, British Cols., Danzig, Belgium, Guatemala, Japan, Russia, French Cols., Italy, Chili, Nijara, Iceland, Argentine, Port Cols. *(Post 2d.)* Per Packet **1/6**

British Made **Fascinating and Instructive**



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Here are the toys you want to work with your models. All real precision jobs fitted with super powerful clockwork motors. The tractor illustrated will pull goods up steep gradients and climb over almost anything; or there is a tank, to use with your soldiers. A model of the latest design, bristling with guns, climbing over the trenches, smashing the barricades. Boys! you will love it! *(Post 3d.)* Tractor No. 1 **1/-**

Tractor No. 2 **3/11** *(Post 6d.)* Whippet Tank **1/3** *(Post 3d.)*

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No. 1 Boy's. Containing 17 chemicals apparatus, and leaflets of instructions, very fascinating. SPECIAL PRICE *(Post 6d.)* **2/-**

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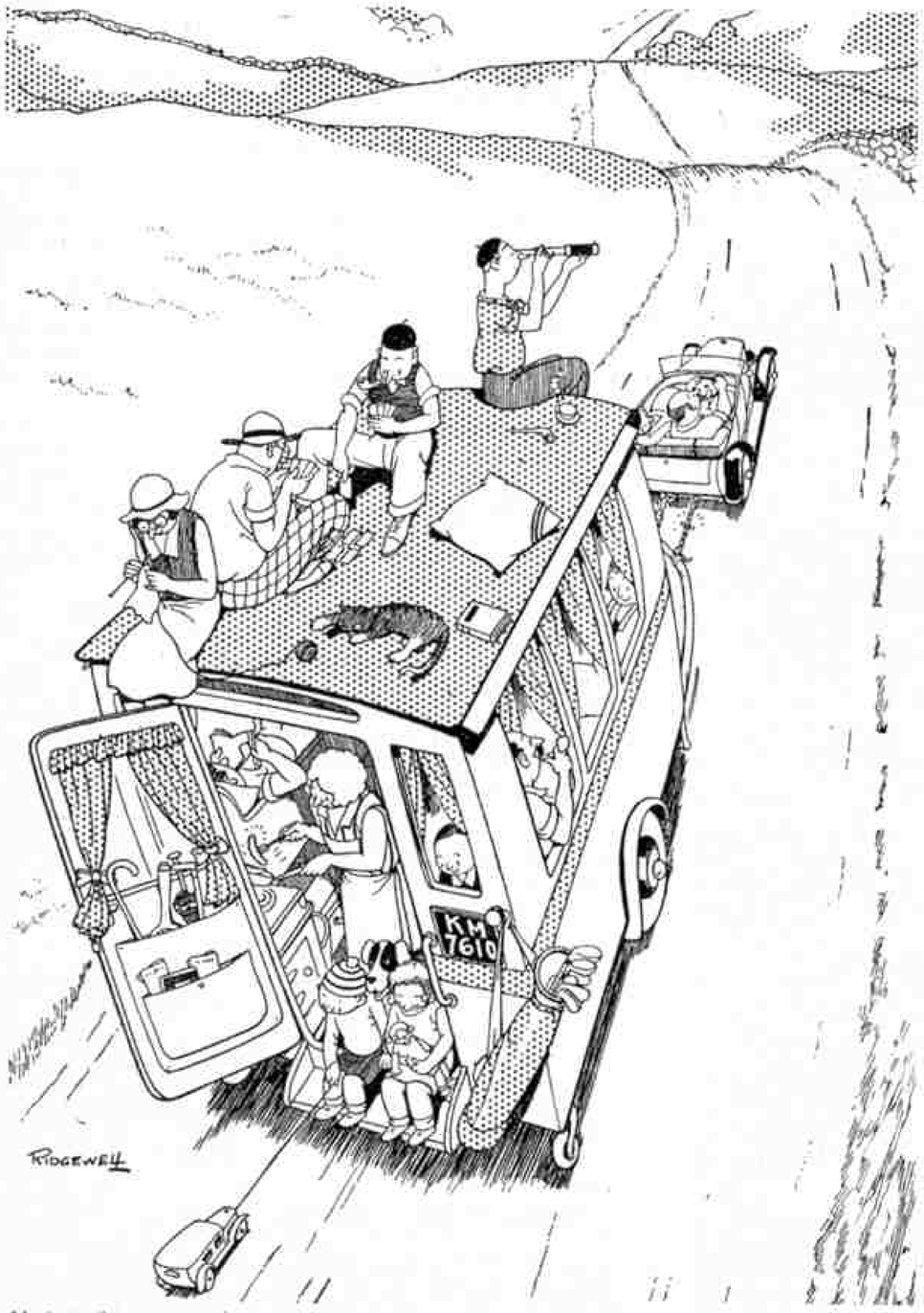

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Fresh Fruit for Drinks

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A glass of Squash—Lemon, Orange or Grape Fruit costs less than 1d. because a large bottle costing 2/– makes 25-30 drinks of pure healthful Orangeade, Lemonade and Grape Fruit, simply by adding water.

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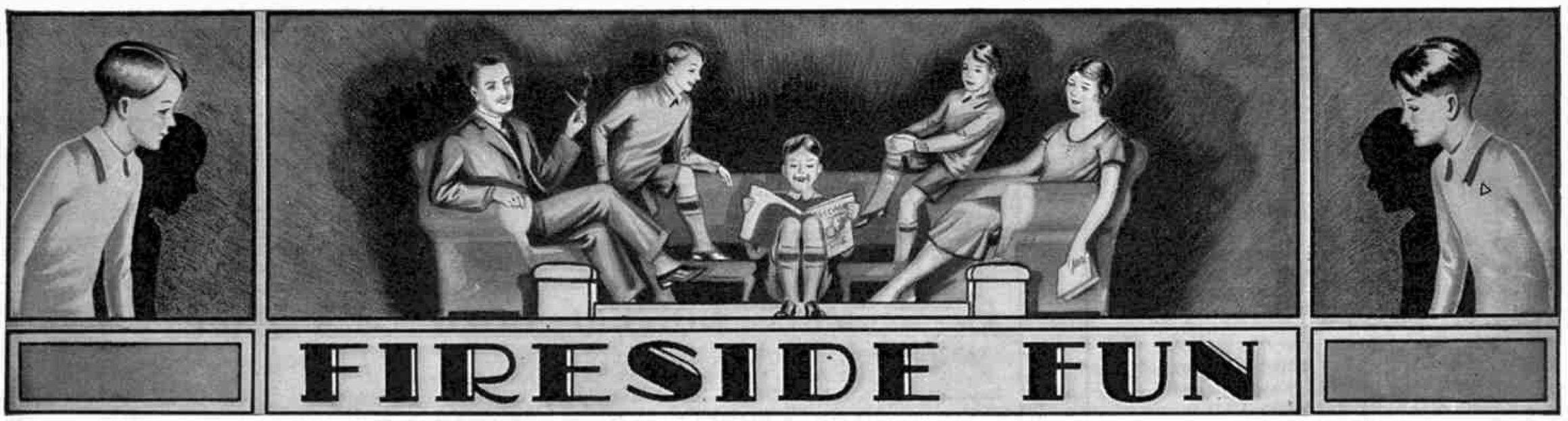


A THOUGHTFUL REPLY

"Yes," said the talkative young man. "I'm very good at thought reading. I can tell exactly what a person is thinking."

"In that case," said his bored listener, "I beg your pardon."

* * * *

Customer (outside barber's shop): "Why are you taking your striped pole down?"

Barber: "Because the circus is coming through town to-day."

Customer: "What's that got to do with it?"

Barber: "Twenty years ago I gave the circus elephant a stick of striped rock and since then he's pulled down my pole whenever the circus has passed through."

* * * *

Man (in crowded tramcar in which lights have gone out): "Excuse me, madam, here is a strap for you to hold on to."

Woman: "I have one, thank you."

Man: "Not at all! You have hold of my ear."

* * * *

Householder (to caller): "If our wireless set is so loud that it annoys you, why don't you go and live in some other street?"

Caller: "But, Madam, I do."

* * * *

A golf professional, employed in the sports department of a big departmental store to give free golf lessons to customers, was approached by two women.

"Do you wish to learn how to play golf, Madam?" he enquired courteously of one of them.

"Oh, no," came the reply. "It's my friend who wants to learn. I learnt yesterday."

* * * *

The Manager was engaging a new office boy.

"What I want," he said, "is a boy who will not always need to be told about everything. The office must always be kept tidy, all loose papers be cleared up, and waste paper baskets emptied. My last boy was dismissed because he displayed no initiative whatsoever in these matters. In short, the greater part of your duties will consist of keeping the office smart. Do you think you will be able to do this?"

"Yes, sir," said the boy. "Shall I start by putting your tie straight?"

* * * *

Aberdonian (in fish shop): "Will ye please gie me one sma' fresh herrin'"

Assistant: "Only one, Mr. MacAngus?"

Aberdonian: "Aye. You see my wife's ill and the doctor has ordered her sea air and I just want the fish to fan her wi!"

* * * *

NOT WHAT SHE MEANT!

"Are you the plumber?"

"Yes, mum."

"Well please be very careful while you are doing your work. All my floors are highly polished."

"Oh, don't worry about me, mum. I shan't slip, I've got nails in me boots."

* * * *

"Why have you brought Mr. Beefman home to dinner, when you know I'm spring cleaning?"

"Hush, my dear! He's the only man I know who can help move the sideboard."

WANDERING MEMORIES

Pat: "That was a foine sintiment Casey got off at the banquet last night."

Mike: "What was it?"

Pat: "He said that the swatest mimories in loife are the ricollictions of things forgotten."

* * * *

An American, who had taken a shooting lodge in Scotland, got lost one day in a heavy mist. Finally he came across a native.

"I'm lost," said the American.

"I know ye're lost, mon," said the Highlander, "but is there any reward for finding ye?"

* * * *

ADVANCED INSTRUCTION

Lady Driver (to infuriated Constable whom she has knocked down): "I'm awfully sorry, Officer, I didn't see your signal until I was right up to you and then I trod on this little gadget and it seemed to do something to the what-you-may-call-it. I hope I'm not being too technical for you."

* * * *

First Holiday-Maker (watching train steam out of station): "If you hadn't wasted so much time at home we shouldn't have lost the train."

Second Holiday-Maker: "Yes, and if you hadn't made me run so quickly we shouldn't have had so long to wait for the next one."

* * * *

Old Lady (on platform): "Which platform for the London train?"

Porter: "Turn to the left, mum, and you'll be right."

Lady: "Don't be impertinent, my man."

Porter: "All right, then, turn to your right and you'll be left!"

* * * *

First Traveller: "London is the foggiest place in the world."

Second Traveller: "Oh, no, it's not. I've been in a place much foggier than London."

First Traveller: "Where was that?"

Second Traveller: "I don't know where it was, it was so foggy."

* * * *

"Good gracious, Mary, what a long pie. It's too big for just two of us."

"Yes, I know, but I couldn't get any shorter rhubarb."

* * * *

"I can't imagine what's the matter with me, doctor; I'm nervy and depressed, and continually thinking about myself."

"Tut, tut! You must stop worrying over trifles."

* * * *

The restaurant advertised rapid service, but did not give it. A patron gave an order, waited patiently and fell asleep. He awoke to hear the waitress' voice.

"Did you order this sundae?" she asked.

"Good Heavens!" exclaimed the customer in dismay, "what day is it now?"

* * * *

Mistress: "I shall be going out this morning. I wonder if I shall need my umbrella. Just go and see what the barometer says, Mary."

Mary: "Oh, it's no use taking any notice of that, mum; it changes with the weather."

CONCRETE ADVICE

Doctor: "The thing for you to do is to stop thinking about yourself. Lose yourself in your work. By the way, what is your occupation?"

Patient: "I'm a cement mixer."

* * * *

Hotel Guest (to maid): "This is absurd. I told you to wake me at eight o'clock and it's only six."

Maid: "Yes, sir, but I thought you'd like to know that you've got another two hours to sleep."

* * * *

"Please father, can I have a drum?" demanded Jimmy.

"What on earth do you want a drum for?" asked his father.

"Because cousin Henry's mother gives him 6d. a week not to play on the one you gave him for his birthday!"

* * * *

The young boy had just been given a fine new horse for a birthday present. During his first ride on it he was cantering past an old man riding a donkey, when he stopped and, turning to the man, said in a jocular tone, "How goes the ass, father?"

"On horseback, young man," retorted the old man.

* * * *

"I 'ear you've got a new job, Bill. D'yer like it?"

"I should think I do! Why, I've got nothing ter do all day. I've only got ter keep carrying some bricks and mortar up a ladder, and there's a bricklayer up on top to do all the work!"

* * * *

Two commercial travellers met in the dining car and soon opened conversation.

"Of course, you're from Lancashire?" one of them said.

The Manchester man replied that he was, and enquired why the question had been asked.

"Oh, I was just accounting for your accent," said the other.

"And where do you come from?" asked the Manchester man.

"Worcester," replied the traveller, innocently.

"Ah, well, now I can account for your sauce."

* * * *

Cannibal Chief (to sole survivor of shipwreck): "What kind of work did you do at home?"

Survivor: "Oh, I was a sub-editor."

Cannibal Chief: "In that case I will promote you. After dinner you will be Editor-in-Chief!"

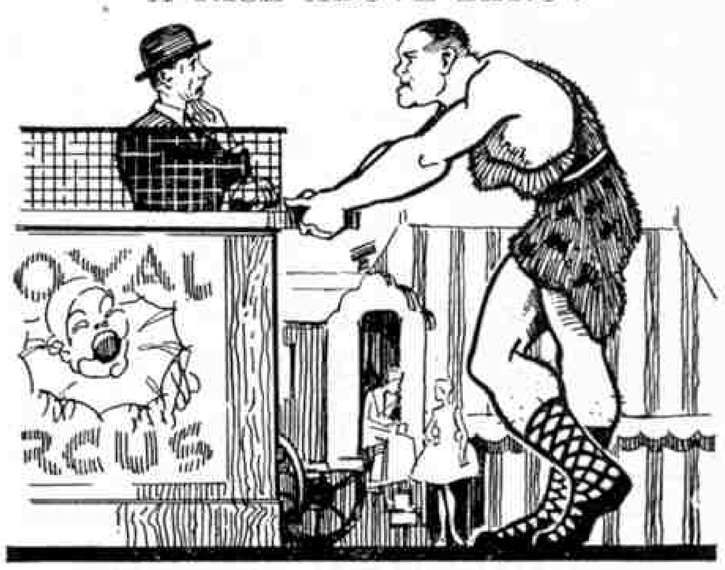
* * * *

Miss Quickrich: "Lady de Vere has a most wonderful Vandyke, for which her husband paid £25,000."

Mr. Quickrich: "Don't you believe it, me dear. No car on the market costs a quarter of that!"

* * * *

A RISE ABOVE ZERO!



The circus was doing badly, and funds sank lower and lower. At last, the cashier pinned up a notice announcing that in future salaries would be paid as funds permitted, and that artists would be paid in the alphabetical order of names. Next day Zero, the strong man, called on the cashier.

"I have come," he said, "to tell you that I have changed my name."

"Oh!" replied the cashier. "And what are you going to call yourself now, pray?"

"Achilles," he said, sourly.

GIBBONS' STAMP CATALOGUE 1933

Don't forget that September 1st is the publishing date of the big new Gibbons' Catalogue—the book that **all** stamp collectors must have. 2,000 pages, full size illustrations, details of designs, footnotes, latest prices, etc., etc.

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J. RUSSELL

Chetwynd, Shanklin Drive, Westcliff-on-Sea

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The countries and stamps in this fine packet have been carefully selected. For example you will find Alaouites, portrait of King Carol, Syria (Hama) an old Egypt, a large Biplane stamp, Latakia, unused Persian stamp, Japan, many overprinted varieties, also the new issue (July 15th) three-cornered Air stamp from Lithuania. All Free. Send 2d. for postage. Request approvals, and we enclose a further grand packet of 50 different stamps.

LISBURN & TOWNSEND (M.M.), LIVERPOOL

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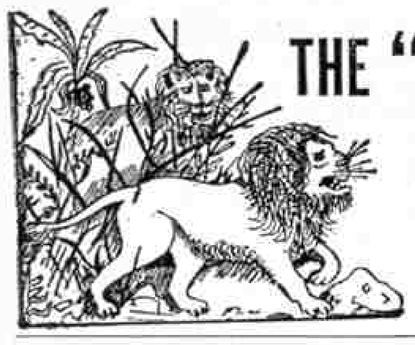

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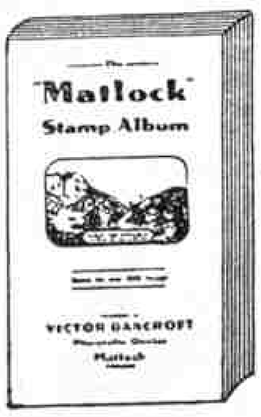

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Boys! Take advantage of this unusual offer! You are bound to want many of these stamps for your albums. The packet contains unusual and scarce items such as : **ESTHONIA** (mint), **CAPE OF GOOD HOPE, CEYLON, SET OF AIRMAILS** (mint), **TURKEY** (palace), **NEW SOUTH WALES, BRAZIL** (airplane), **PHILIPPINE ISLANDS** (obsolete), **HUNGARY** (war charity), and the earliest issue of **NICARAGUA** (cat. 7/–) ; also a **FURTHER 30 GOOD QUALITY STAMPS** are included, among which are **COLONIALS, COMMEMORATIVES,** and several **UNUSED.** This grand packet is **ABSOLUTELY FREE** to all genuine applicants for approvals who enclose 2d. for postage. Write **NOW,** as the supply is limited.

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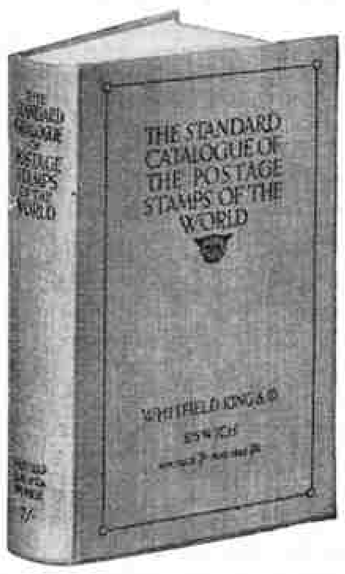

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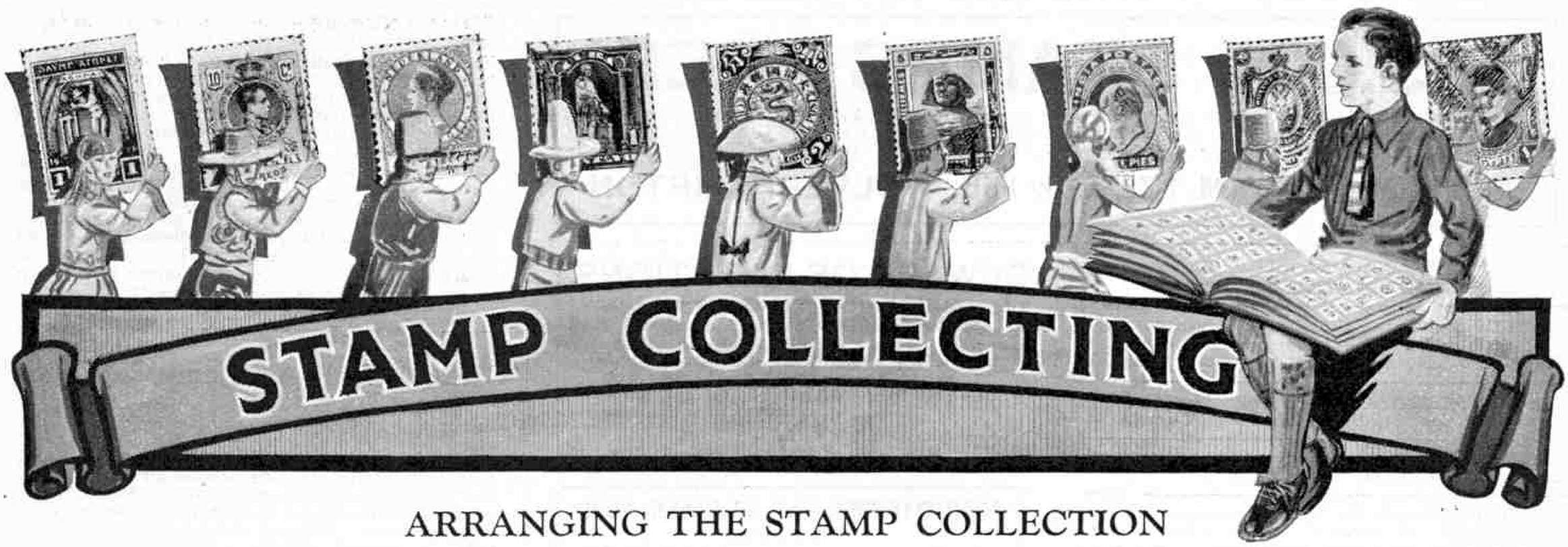

ARRANGING THE STAMP COLLECTION

AT this season of the year many readers will be taking up stamp collecting for the first time, and a still greater number will be resuming their interest after a summer's hibernation. A few words on the arrangement of a stamp collection will be timely, therefore, for a well-arranged collection is the hobby's greatest joy—and the thing most rarely met with.

The majority of our readers doubtless commenced stamp collecting with a fixed leaf album, and in most cases they made an endeavour to assemble their then small collection in neat formation. As time went on, they found it increasingly difficult to maintain a neat appearance; certain well-filled countries had to encroach upon space allotted to other countries, and finally the effort to preserve reasonable order had to be sacrificed to the sheer necessity of making room somewhere. There lies the tragedy of the fixed leaf album. It has many advantages, and unquestionably it is helpful to the beginner; but it cannot keep pace with the times, or adapt itself to the changing ideas of the growing philatelist.

The remedy lies in the use of the loose-leaf album. In first cost it may be slightly more expensive, but it has the advantage that the perfect display of one issue creates no difficulty in housing remaining issues of the same country, for additional leaves can be inserted and allocated as required. Further, there is no waste space devoted to countries that are not represented in the collection.

The choice of album is important and, as in all other matters of stamp collecting, it will prove a sound maxim to buy the best that can be afforded. It should be borne in mind, however, that the heaviest paper is not necessarily the ideal paper on which to mount stamps. Highly glazed or very rough papers should be avoided. A good plan is to test a sample, rejecting any paper that will not take writing, or that tears badly when a cheap stamp mount is detached from it.

This is the only occasion on which a stamp collector should use anything less than the very best of stamp mounts. A good peelable mount costs only 8d. per 1,000, and can be detached from the back of the stamp or the page of an album without leaving more than a mere trace. The removal of a cheap mount is an operation involving considerable risk of damage both to stamp and album page, so that the saving of three or four pennies on a cheap packet of stamp mounts may prove a very expensive economy.

The size of the page is not an important matter. There are several sizes about 11 in. × 9½ in. that may be considered standard, and for which additional leaves can be purchased at reasonable cost without difficulty. These pages are usually printed with a decorative border and a series of very faint small squares, known as the "quadrille," to serve as guides in arranging the layout of the stamps. Space is provided at the head of the page for the title of the country and, while readers possessing a measure of artistic ability may decide to write their own titles, it will be comforting to the less confident to know that sets of suitable titles, printed on gummed paper, may be purchased.

The arrangement of the stamps is largely a personal matter for each individual. It is his opportunity to infuse personality into his collection and, that being so, we can offer only general suggestions. At the outset it is well to decide the maximum number of stamps that may be placed on one page, keeping in mind the point that the loose-leaf album has been adopted to avoid over-crowding, to enable each individual stamp to be studied as a stamp and not merely as one of a bunch. Mr. W. E. Fyndem, in an excellent series of articles now appearing in *"Stamp Collecting"* on this very topic of reconstructing a stamp collection, has suggested 12 as an ideal maximum number, in order to give each stamp a surround equal to its own width and depth. In some circumstances it will be found desirable and necessary to exceed that number, in others it will be found essential to reduce it; but in practice 12 will prove a happy working basis.

An important principle to observe is not to permit stamps from two different issues to appear on the same page. Where an issue contains about 10 to 15 or 18 to 20 stamps, obviously there will be no difficulty in carrying out that rule, for the whole of one page or of two pages will be used. There will be rare occasions, however, when a series will contain more stamps than can be accommodated on one page, and yet insufficient to call for two whole pages, say 16 or 17. In a case such as this the rule must be broken by dividing the set into two parts, high and low values, for example: pence and shillings in the case of a British issue, or centimes and francs in a French series. The low values may be arranged on the first page, and the high values allocated *to the bottom of the next page*. That will leave the upper half available for the use of a short series of the same country.

Undoubtedly the thorniest problem to be faced by the young collector is the undesirability of mounting used and unused stamps together. The mingling of used and unused stamps does create a patchy appearance, and undoubtedly, when endeavouring to reconstruct a stamp collection, one must be prepared to discard the old untidy methods under which all varieties of stamps were thrown together. The young collector who has little money to spend on the hobby, and is compelled to rely upon gifts of used stamps from friends in business houses, should concentrate upon used varieties, and make it a rule to mount his unused specimens in another album. It must be emphasized that only clean, lightly postmarked copies should be mounted. Heavily marked copies are not to be tolerated in the case of common issues, and should be included only as a temporary measure in others. In no circumstances should damaged stamps be included.

Monotony of arrangement must be avoided. It will be almost impossible to avoid having several pages alike in a fairly extensive collection, but those pages must be kept apart; the eye of the beholder must have something new to look on with each succeeding turning leaf. No two successive rows on a page should contain the same number of stamps, and it is a good rule to make alternate rows odd and even. Most important of all, the stamps must be balanced on the centre point of the page. *(Continued on next page)*

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For full details of the above gigantic gift scheme write now enclosing postage for any one of the following, FREE:—103, including Alaouites, Syria and Leban. 25 old Bavaria, 5 fine ICELAND (inc. 2 heads) or 25 special FINLAND. Ask for Approvals. ENCLOSE POSTAGE ONLY. OVERSEAS 3d.

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* Unused. Postage 1½d. extra. All different.

W. BENNETT, 53, Marlborough Road, London, E.8.

Stamp Collecting—(*Continued from previous page*)

This point is actually marked in the quadrille by a little cross, and if it is decided to occupy the point with a stamp, the remaining stamps must be arranged to radiate from this point. If the central space is left clear the stamps must circulate around that pivot, as it were.

An immense amount of advice could be added to these comments on cardinal points of layout, but they would consist largely of personal views, and it cannot be too strongly emphasized that the charm of the well-arranged, well-written-up collection is in its expression of its owner's ideas. Those readers who would like further advice on their layout problems—or any stamp question—should write to the Editor, who will gladly do his best to solve the difficulty.

Gibbons' 1932 Air Stamp Catalogue

The rapid extension of air mail activities throughout the world is strikingly demonstrated by the considerable increase in size in the 1932 edition of Gibbons' Air Stamp catalogue. It is not possible to say offhand the number of issues that are included for the first time, but the figure certainly runs into hundreds. As a production the catalogue is a great improvement upon its predecessor. The page size has been reduced by half, for example, and as a result a handy-sized compact volume is produced.

Sharp increases in price among the early "star" issues, such as the famous Newfoundland "transatlantics," were to be expected, but the extent of the increases is surprising. They average between 25 and 50 per cent. The upward movement is not confined to the "star" pieces, however, for the low-priced issues are also advancing rapidly. Judicious purchase now must show a handsome profit in the course of the next few years.

Gibbons' catalogue is not intended to cover the whole range of aero-philately, but, for the present at least, is to confine itself simply to air mail stamps. For this reason the popular literary supplement to the 1931 edition disappears. This will be a matter of regret to many collectors, and we suggest to Messrs. Gibbons that they should include in each annual edition a concise review of the air mail development of the preceding year.

The catalogue may be obtained from Stanley Gibbons Ltd., 391, Strand, London, W.C.2, or from any stamp dealer, price 2/6, or 2/9 including postage.

New Racing Craft

Messrs. Bowman Models, manufacturers of the well-known model boats and aeroplanes, have recently put on the market a very interesting new rubber-driven racing craft which sells at the exceptionally low price of 1/3. This vessel, named the "Whirlwind," is 27 inches in length, which is longer than many more expensive models. It is beautifully made of wood and is fitted with a cabin, rudder, and metal spray-hood. The propeller has twin blades and is driven by a fast and powerful rubber motor. The "Whirlwind" is painted in three colours and, altogether, is a very smart affair and excellent value for money.

"Miss England III"—(*Continued from page 657*)

wide open, but if the pedal is lifted slightly, the driver, by twisting his foot in one direction or the other, can speed up or slow either engine in relation to the other. This allows the pilot to manipulate the engine power in conjunction with the rudders for turning at fast speeds.

On the dashboard of the boat there is an almost bewildering array of instruments, including revolution indicators, timing clocks, ignition switches, oil and water temperature and pressure gauges. There are also others that indicate the supercharger boost pressure, and fuel and oil gauges and warning lights, all of which come under the charge of Mr. Kaye Don's engineer.

It is interesting to note that the hull when completed weighed within .05 of a ton of the estimated weight, and the complete boat, with all machinery and accessories installed, has a total weight of 12,758.5 lb., or approximately 5.6 tons; equivalent to only 3 lb. per b.h.p.

This Space is set to ½ inch s.c. and costs 8/- per month. The sum is the 50th of £20, the price of a whole page advertisement. Over 90,000 copies of the December number were distributed all over the world. You therefore reach this exclusive public for approximately one penny a thousand.

UNPARALLELED

THE MONTH'S FINEST FREE GIFT

A super packet containing a fine **ROUMANIAN AIR STAMP, ERITREA** pictorial, **ALBANIA,** SAAR, BELGIAN CONGO, LEBANON, Luxembourg, Syria, and many beautiful pictorials, a really wonderful addition to your collection. Simply request approvals.

NOT EVEN POSTAGE REQUIRED.

R. HEWSON, 36, STERT ST., ABINGDON, BERKS.

Stamp Gossip

and Notes on New Issues

Attracting the Tourist

To aid the funds of the Netherland Tourist Association, Holland has issued a special series of stamps to be sold at a premium. It consists of four values with striking pictorial designs showing aerial views of Dutch scenery, each with a foreground design superimposed on the view as follows :—2½c. + 1½c., Windmill and dykes ; 6c. + 4c., Aerial view of church ; 7½c. + 3½c., Scene at canal locks ; 12c. + 2½c., Fields of growing tulips. The initials of the Tourist Association, ANVV, and the friendly greeting, *Salve Hospes*, are incorporated in each design, as is shown in our reproduction of the 12½c. stamp.

The 32c. Philippine Islands stamp, illustrated here, is also from a stamp series issued for the express purpose of attracting tourist traffic. The view shown is of the famous Baguio Zigzag, a tortuous motor road leading from Dagapan to Baguio, capital of the Benguot mountain province, a summer resort 5,000 feet above sea level. The track is a series of hairpin bends and the speed enthusiast will discover in it more thrills to the mile than any Tourist Trophy motor cyclist can find in a circuit of the famous Isle of Man track.

The full Philippine's set contains seven stamps, the designs used for the other stamps being : 2c., Mayon Volcano ; 4c., Post Office, Manila ; 12c., No. 7 Pier, Manila Bay ; 20c., Rice plantation ; 24c., Rice terraces.

Mongolian Pictorial Issue

Among the most interesting of recent new issues, Mongolia's new series is worthy of comment. It is the country's first pictorial set. The designs introduced for the 13 stamps may be said to range themselves in three groups :—First, 1 mung, Printer ; 2m., Telegraphist ; 5m., Mechanic ; 10m., Factory ; Second, 15m., Revolutionary soldier ; 20m., Mongol group ; 25m., Mongol soldier ; 40m., Syke Bator, the late revolutionary leader ; 50m., Syke Bator memorial : Third, 1 tug. Mountain view ; 3t., Sheep shearing ; 5t., Camel caravan ; 10t., Moorland scene.

A Mighty Task

A romance of stamp production lies behind the bare official announcement that the United States Congress have passed a measure enacting an increase in the postal rates for first-class mail from two to three cents. Within a very few hours of the signing of the measure, the State Bureau of Engraving and Printing had set its presses to the production of four billions of 3c. stamps—at the rate of 100 millions per day !

In addition, the Post Office Department faced the task of turning out 300 millions of 3c. stamped envelopes, one billion additional 1c. stamps for emergency use with 2c. stamps and 2c. stamped envelopes, and several hundred millions of 1c. and 3c. postage dues.

The new 3c. stamp is purple in colour and takes for its design the same portrait that is used on the 2c. Washington bi-centenary commemorative. The bi-centennial dates, 1732-1932, are omitted, however. Thus the U.S.A. enjoys the uncommon experience of having two stamps current with identical designs.

There is a more curious outcome of the change-over, however. There are actually four varieties of 3c. stamps in current use : the 3c. Lincoln portrait, first issued in 1922 ; the 3c. Washington bi-centennial commemorative ; a 3c. violet Olympic Games commemorative issued on 15th June ; and the new 3c. already described.

The Olympic Games stamp was to have been issued as a 2c. value in May, but its appearance was deferred pending the Congress decision on the proposed alterations in the postal charges. The design of the stamp shows a sprinter on his mark. There is a companion stamp, a 5c. blue depicting a discus thrower.

* * * *

The huge sale commanded by a popular commemorative issue is illustrated by the success of Australia's Sydney Harbour Bridge issue. The entire supply of surface printed copies of the 2d. stamp, 25 millions, was exhausted on 23rd April. The two millions of line-engraved 2d. stamps were sold out by the second week in April.

Australia's new 6d. stamp, the second of the " fauna " series, has now been issued. As will be seen in our illustration, the design is very similar to that of the original Kookaburra stamp issued in 1914.

Railway Commemoratives

Stamp collecting members of the Hornby Railway Company will be specially interested to see our illustration of the railway commemoration stamps recently issued by the Republic of San Marino to celebrate the opening of the electric railway between San Marino and Rimini.

The series contains four values, 20c., 50c., 1L25 and 5 Lire, each using the illustrated design.

Another interesting railway event, the 50th anniversary of the opening of the St. Gothard Railway in Switzerland, has been celebrated with postage stamps, Switzerland having issued a short series of three stamps, denominated 10c., 20c. and 30c., respectively, bearing portraits of M. Louis Favre, the engineer responsible for the construction of the tunnel and railway ; M. Alfred Escher, the first President of the railway's administration, and M. Emil Welti, one of the original inspirers and supporters of the project.

Stamp Statistics

Those stamp collecting readers who revel in figures will be interested to examine the following table of new stamp issues for the year 1931 :—Europe, 488 ; Asia, 224 ; Africa, 518 ; America, 471 ; Oceania, 83. Air stamp issues included in these figures are :—54, 21, 66, 107 and nil respectively, a total of 248, 14 per cent. of the total.

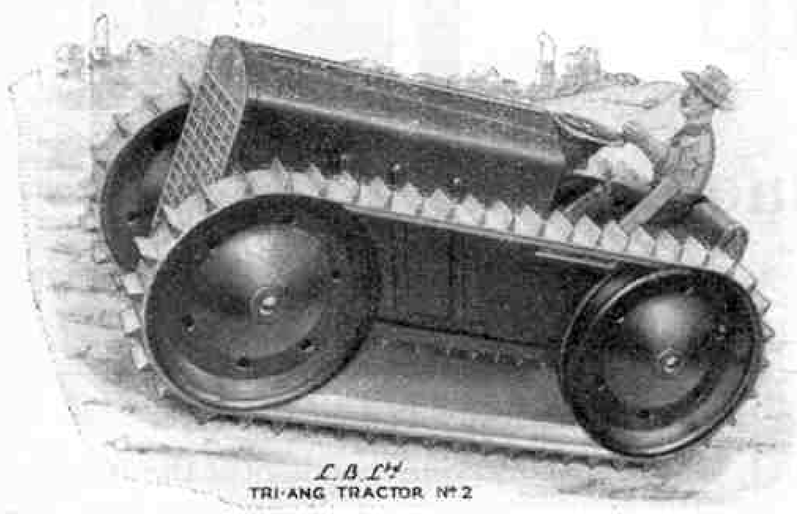
Commemorative issues accounted for 422 (24 per cent.), a considerable decline on the 1930 figures, when there appeared 615 commemoratives, representing 36 per cent. of the total of 1,660 new issues for 1930.

* * * *

To mark the 400th anniversary of the landing of the Portuguese navigator, Martin Alfonso da Souza, at Cape St. Vincent near Santos, and the subsequent colonisation of the country, Brazil has issued a commemorative series of five stamps, with designs as follows :—20 reis, Meridian of Tordeshila ; 100 reis, Ramacho and Tiberica ; 200 reis, Alfonso da Souza ; 600 reis, King Joao III ; 700 reis, Da Souza's landing.

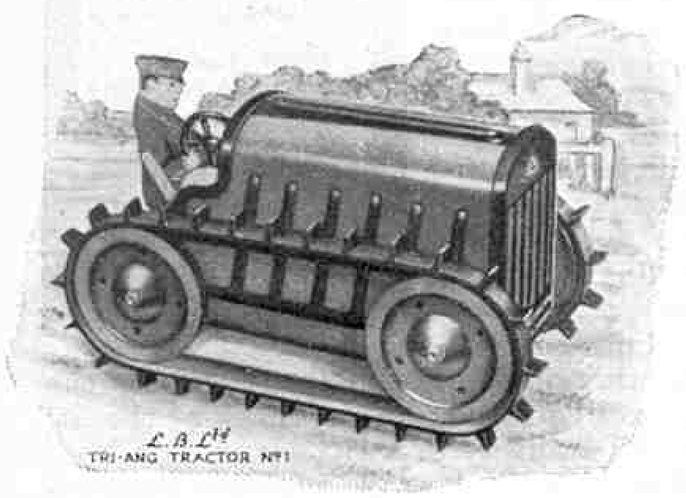
We thank Stanley Gibbons Ltd. for their courtesy in loaning the stamps from which the illustrations for our stamp pages have been made.

New Tri-ang Powerful Clockwork Toys



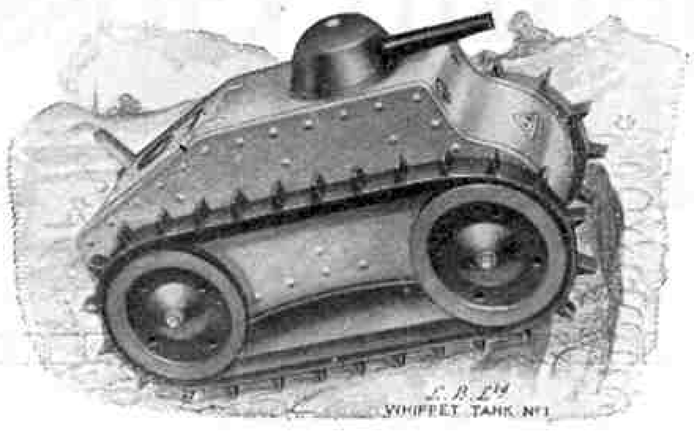
TRI-ANG TRACTOR No. 2. - - 3/11d.

Steel construction, cellulose painted red. Reliable motor with control lever. Rubber bands on steel wheels.
- - - - - - - - - - Length 8½ ins.



TRI-ANG TRACTOR No. 1 (Nippy) - 1/-

Climbs obstacles in a surprising way. Thick rubber bands. Control lever. - - - - - - - Length 5¼ ins.



"WHIPPET" CLIMBING TANK No. 1. - - - - - - 1/3d.

A miniature of a climbing fighting tank. Strong motor, control lever. Swivelling gun turret. Rubber bands. - - - Length 5½ ins

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Regd. Trade Mark.

TIGER CLIMBING & FIGHTING TANK No. 2 - - - - - 5/11

A powerful climber, made of steel, with wide rubber bands. Swivelling gun turret with firing device. Control lever. - - - - Length 10 ins.

A fine new range of clockwork toys to work with your models. Real precision jobs, British made—Tractors, Tanks and Motor Cars. There are other models besides those shown here, including Magic Sports, Saloon and Racing Cars. Get full particulars now.

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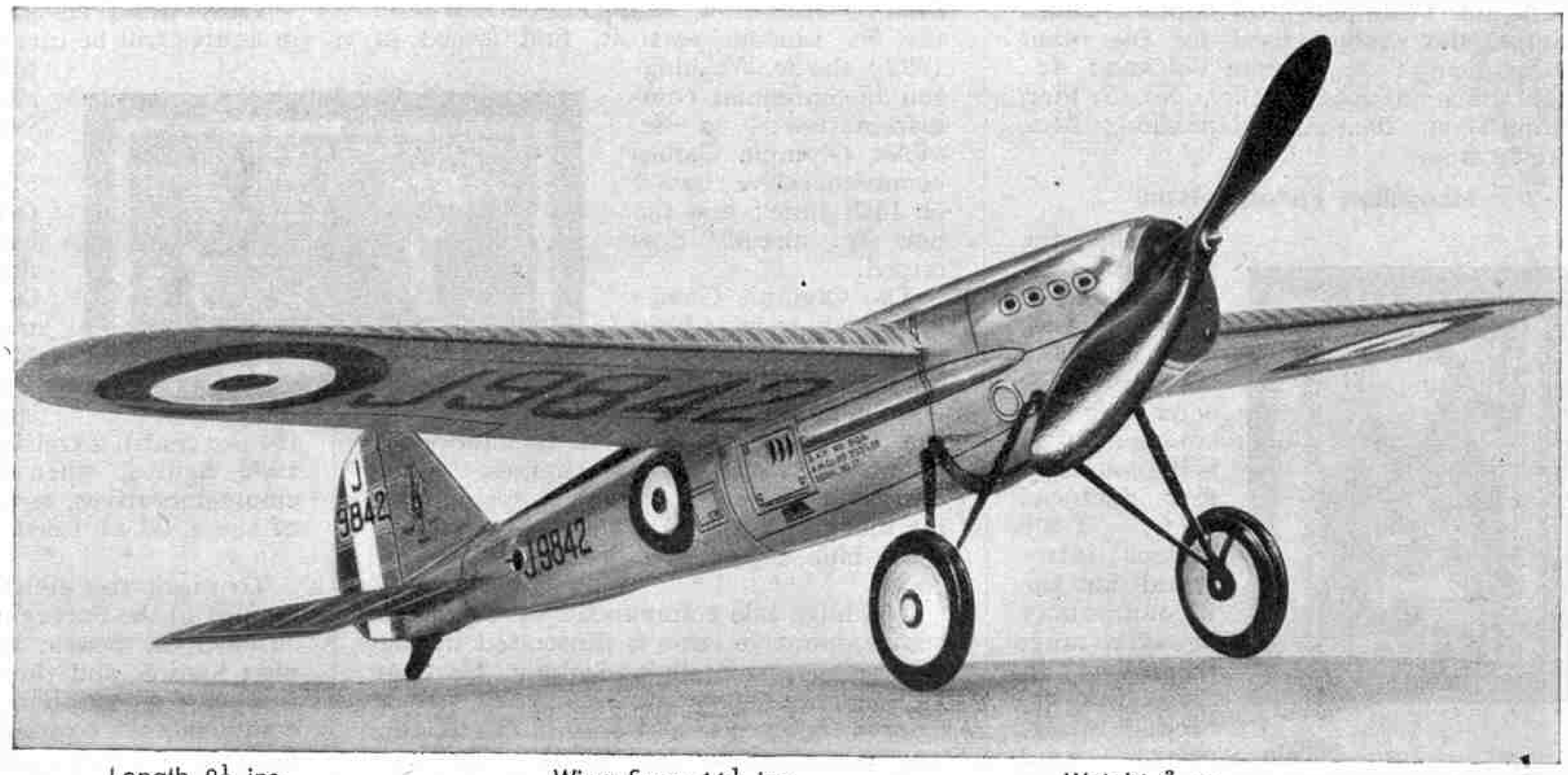
The F·R·O·G Flying Model Interceptor Fighter

A perfect scale model of the real thing. Rises from ground in 3ft.—flys 300 ft. Fully wound in box in less than 1 minute. Performs all the evolutions of a real machine, including looping the loop. Patent construction avoids damage



Length 9¼ ins. Wing Span 11½ ins. Weight ¾ oz.

F R O G TRADE MARK REGD.

British Made by INTERNATIONAL MODEL AIRCRAFT LTD.

Write for particulars to the sole concessionaires:—
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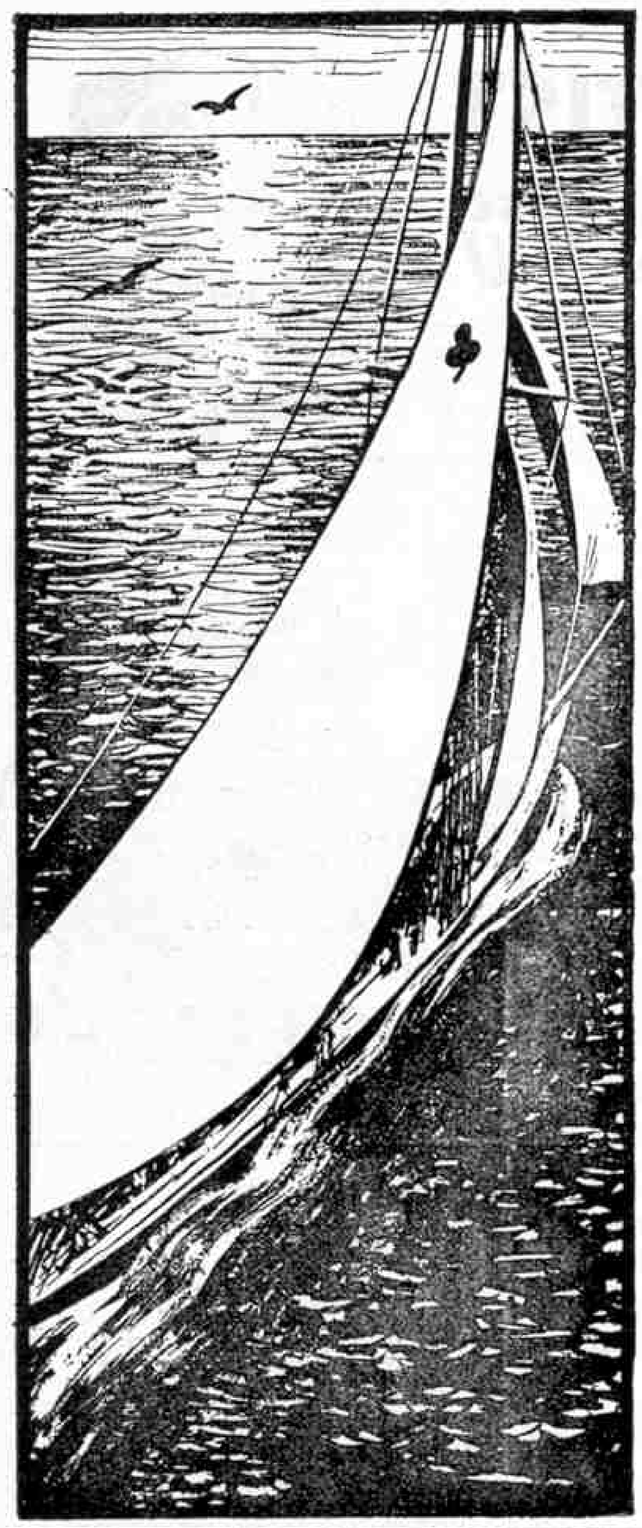
PRICE 10/6



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Have you ever thought of the colossal strain placed on the mast of a big racing yacht? When Sir Thomas Lipton's famous Shamrock I broke its mast, SECCOTINE was used to repair it. That is PROOF OF THE STRENGTH OF SECCOTINE, the world's most famous adhesive.

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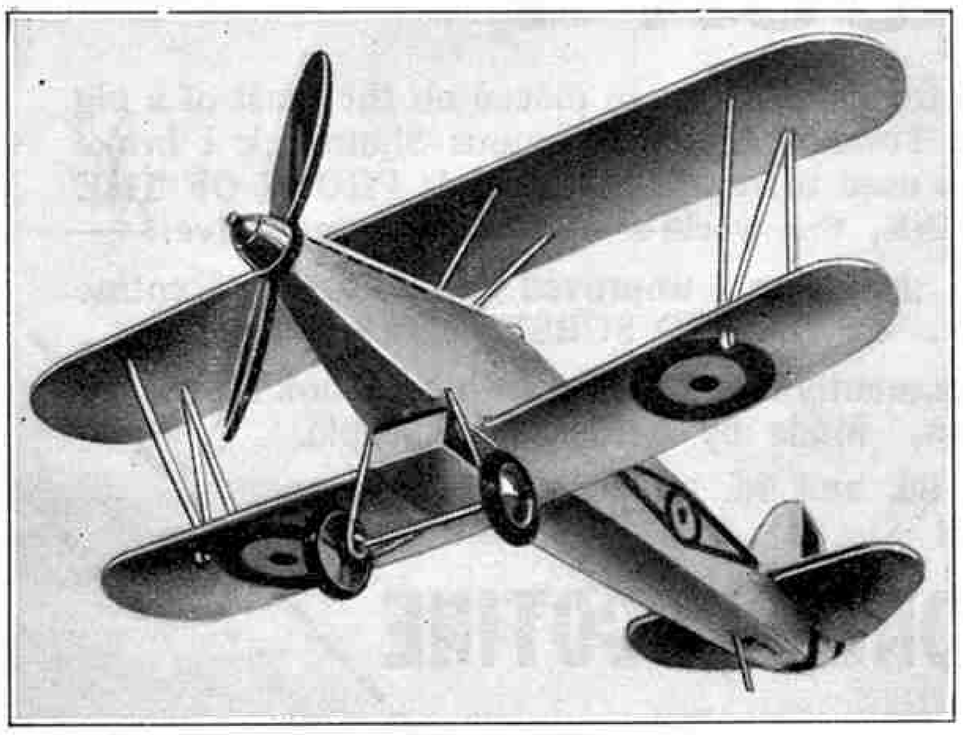
A SKY BIRD constructional set costs only **2**/–.

Start your collection with a "Hawker Fury Interceptor Fighter." Made of Mahogany, with Brass fittings (all cut to **1**/**70**th scale) and holes to mark the correct positions for assembling.



When you have assembled and painted a "Hawker Fury," you will want two more to complete your "Flight." Just imagine, a complete "Flight" for **6**/–, or, better still, a full squadron for **18**/–

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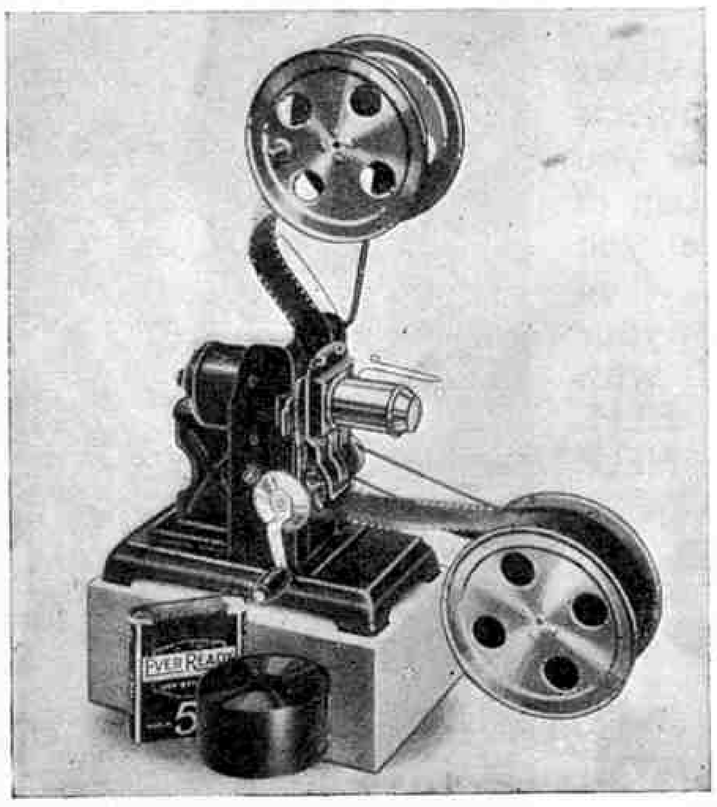

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These are some experiments :—Growing Chemical Trees ; Big Crystals ; making coloured flares, etc., etc.

Lott's Chemistry is supplied in 5 sizes—larger boxes will shortly be ready.

BOX 1 with 18 Chemicals, accessories and book of 42 experiments. **Price 3/6**

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BOX 4, larger size, with 38 Chemicals, apparatus, etc., and book of 181 experiments. **Price 15/6**

BOX 5 with 43 Chemicals, additional apparatus, and book of 228 experiments. **Price 21/–**

The above prices apply in Great Britain only.

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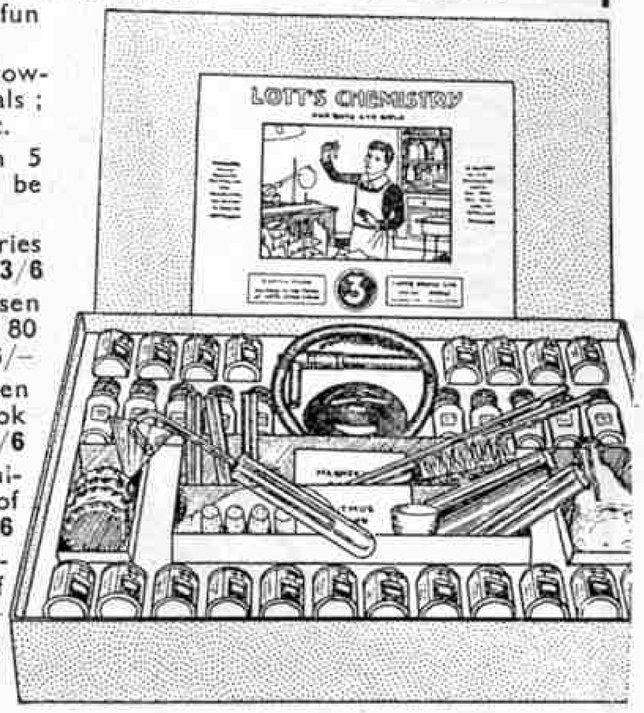

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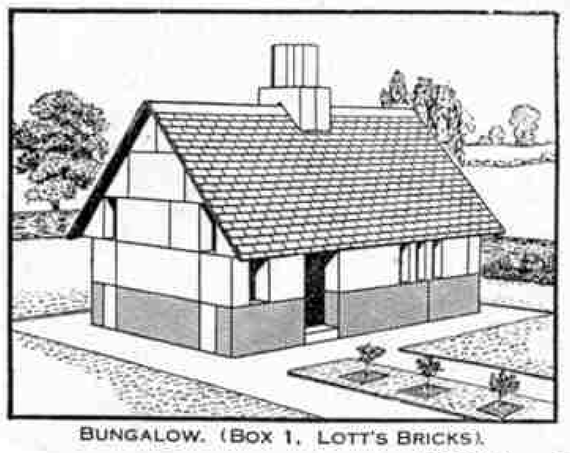
For your Model Railway

It's great fun loading up your trains with bricks and sending them off by rail to the sites chosen for the buildings. What realistic models, too, you can build with Lott's Bricks :—Houses, Bridges, Towers, Railway Stations, Garages—in fact, all the buildings you see about you every day. The Tudor Series contains many designs of Old English half-timbered buildings. Lodomo sets are complete with bricks embossed with designs of Doors, Windows and Bonded brickwork. All the sets contain illustrations of the models printed in colours.



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A few particulars of some of the sets :—

BOX 1. Contains bricks, roofs, trees and fences, and plans for 30 models. **Price 5/–**

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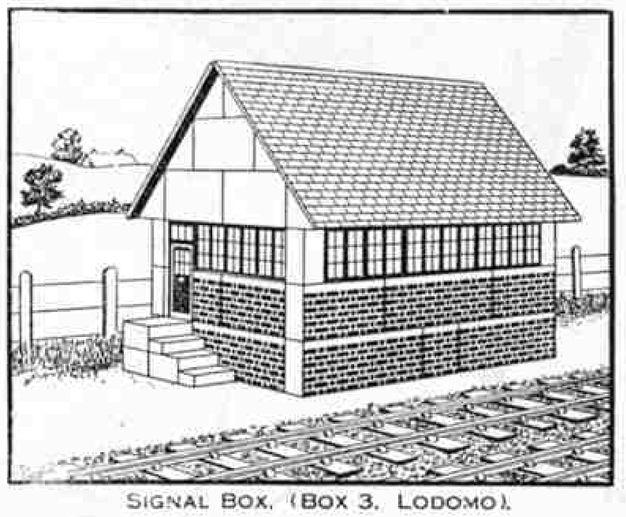

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Thousands of different experiments, all interesting and intriguing, certain to delight the heart of any modern boy, can be performed with the materials supplied in the KAY CHEMISTRY OUTFITS. There are splendid outfits for students at all prices :—1/–, 2/6, 5/–, 7/6, 10/6, 15/–, 21/–, 35/–, 63/– and 105/– each, and every set above 2/6 each includes a splendid BUNSEN BURNER.

In the 10/6 outfit, illustrated above, there are 34 different chemicals, and a splendid assortment of glass tubing, filters, test tubes, rubber tubing, corks, asbestos papers and millboard, Bunsen Tubing, trays, scoops, test tube holder, test tube brush, Bunsen Burner and a splendid book full of experiments and instructions.

What a wonderful difference

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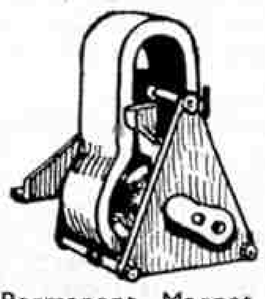

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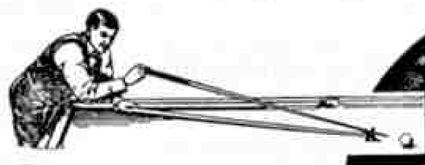

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Riley's "Home" Billiards will bring a wonderful source of pleasure and interest to your home and thereby provide an unfailing inducement to the children to stay indoors during the dark evenings. You and your friends, too, will be fascinated by this splendid game, and dull evenings in your home will be unknown. A Riley "Home" Table is within the reach of everyone. 13/3 down brings the 6-ft. size (cash price £11 15s. 0d.) to your door on 7 days' free trial. Riley's pay carriage and take all transit risks. Other sizes and prices :

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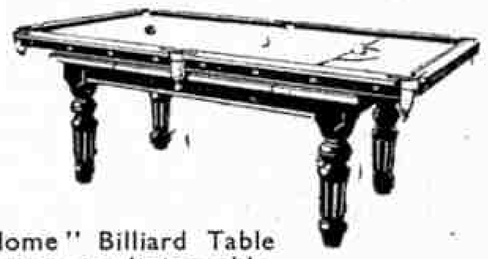
5 ft. 4 ins. x 2 ft. 10 ins.	£ 9	0 0
6 ft. 4 ins. x 3 ft. 4 ins.	£11	15 0
7 ft. 4 ins. x 3 ft. 10 ins.	£15	0 0
8 ft. 4 ins. x 4 ft. 4 ins.	£21	10 0

or in 20 monthly payments of 8/–, 10/3, 13/3, 17/–, 24/6.



Riley "Home" Billiard Table shown resting on a dining table.

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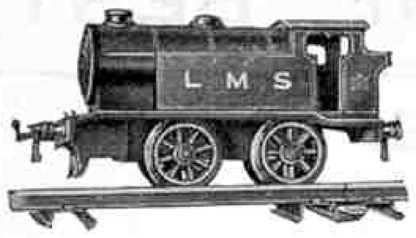
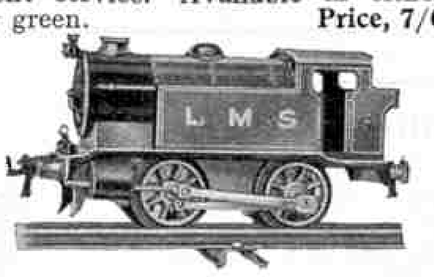
HORNBY TANK LOCOMOTIVES



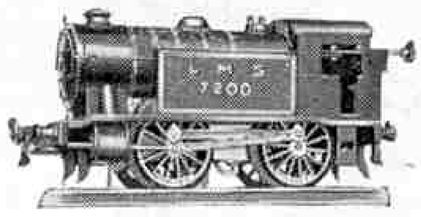
M3 Tank Locomotive

M3 TANK LOCOMOTIVE. This is the powerful Locomotive (reversing) supplied with the Hornby M3 Tank Goods Set. It is a handsome and extremely reliable model that will give long and excellent service. Available in either red or green. **Price, 7/6**

No. 1 TANK LOCOMOTIVE. This strong and durable Locomotive is capable of any amount of hard work. It is fitted with brake mechanism and reversing gear, and is supplied in colours to represent L.M.S.R., L.N.E.R., G.W.R. or S.R. Locomotives. **Price, 13/6**



No. 1 Tank Locomotive



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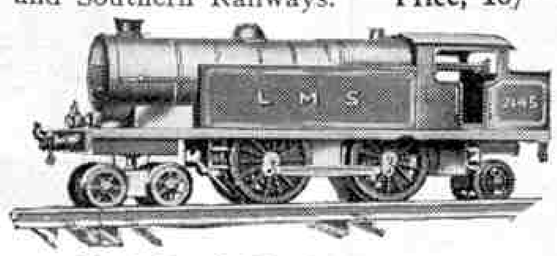

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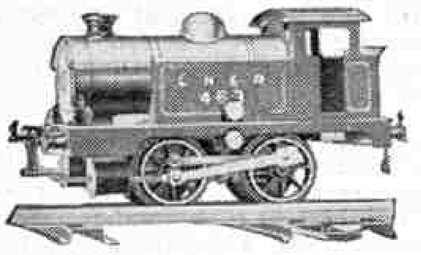

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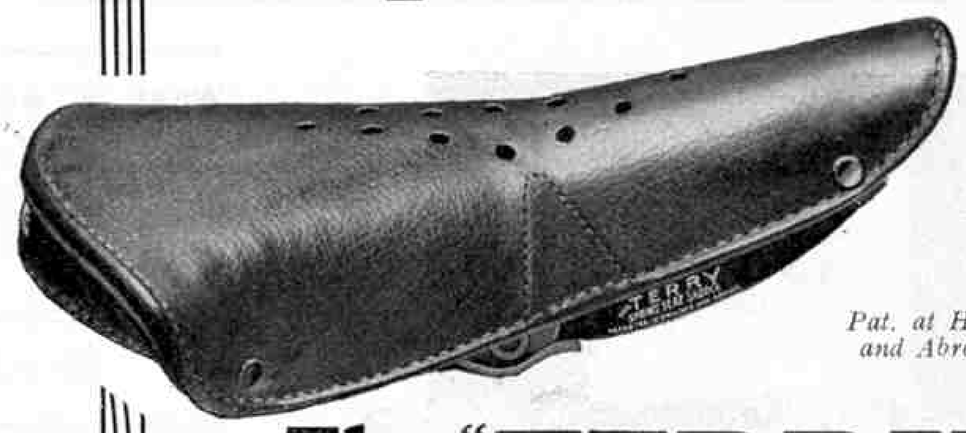

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Putting the Sun to Work—(*Cont. from page 675*)

parabolic cross-section. By means of this the Sun's rays were brought to a focus on a pipe 2¼ in. in diameter that ran the full length of the heater. The pipe contained oil, and its two ends were connected to the top and bottom respectively of a large tank that acted as a reservoir. The oven was built into the tank in such a manner that the oil could circulate freely round it.

As our illustration shows, the heater was placed in a sloping position with the tank above it. When the oil in the pipe became hot it made its way upward in the reservoir in exactly the same manner that water heated in the boiler of a domestic hot water system rises into the storage cylinder. Cold oil flowed to the lower end of the heating pipe to take its place, and thus a regular circulation was set up that maintained the oven at a sufficiently high temperature for slow cooking. The oven, the oil pipes, and the back of the mirror were covered with thick layers of non-conducting material. The result was that the heat produced during the day was retained throughout the night by merely closing taps that restricted the circulation of the oil, and next morning the oven was sufficiently hot to cook breakfast cereals.

A glass cover was used to exclude dust from the polished metal surface of the reflector. It was difficult to keep this sufficiently clean to allow the Sun's rays to enter without loss of power, however, and the mechanism that tilted the trough to make it point towards the Sun at all hours of the day was not very efficient. In spite of these drawbacks good work was done with the oven, and it is said that its fortunate owner was the envy of his neighbours, for it was situated in the open air and in consequence its surroundings were very cool and agreeable.

One difficulty encountered by Dr. Abbott was that of adjusting the temperature of the oven, but this problem was partially solved by introducing a second return pipe leading from the middle of the oil reservoir. Valves were fitted to both return pipes, and the oil could then be passed back to the heater after descending through the upper half of the reservoir only, leaving the liquid at the bottom unaffected. By providing an alternative oil circulation in this manner the heat could be concentrated in the upper part of the oven when necessary.

There is no doubt that further experiments will be made on the direct utilisation of the heat of the rays of the Sun, both for heating purposes and for the production of power. Unless a new principle is discovered, however, it is scarcely likely that the present methods of generating heat and power will be displaced on a large scale for a considerable time, owing to the greater cost of direct methods.

Railway Speed-Up—(*Continued from page 683*)

sterling achievement. They had done their work supremely well and given us an exhibition of the very perfection of engine running. They had made no attempt at record-breaking. Their aim had simply been to keep their exacting schedule and arrive to time in spite of delays, and most ably had they achieved their purpose. The four service slacks at Great Bridgeford, Stafford, Polesworth and Rugby were observed with scrupulous care, and at no point was there any risky running. The early checks and the Boxmoor slack had taken fully 10 min. out of an already very tight schedule; yet in spite of all Euston was reached before time, and the net time from Liverpool was but little over three hours.

It is interesting to recall in this connection that almost 100 years ago, when the Liverpool and Manchester Railway was in successful operation and the London and Birmingham and Grand Junction Railways were under construction, Dr. Dionysius Lardner, in his book on "*The Steam Engine*," expressed his belief that "on the completion of the line of road from the metropolis to Liverpool we may expect to witness the transport of mails and passengers in the short space of three hours." The prophecy of this learned writer—who was also a clergyman—has had to wait a long time for its fulfilment, but almost any day may witness it now.

More accelerations are promised for September, and many already fast trains will be speeded up. In the Liverpool services, the 11.50 a.m. from Euston is to be accelerated by 20 minutes, the 2.35 p.m. by 16 minutes, and the 4 p.m. by 18 minutes. The popular 5.55 p.m. non-stop is to be altered to leave at 6.5 p.m. and reach Lime Street at 9.40 p.m.

These are but a few of the many accelerations arranged for September. Is it not abundantly evident that 1932 will be a red-letter year in the history of railways and that a new standard of express speed has come into force? Apparently full use is to be made of the capabilities of modern locomotives on our perfectly-aligned permanent way.

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Meccano Ltd., Old Swan, Liverpool.

Printing Machine—(*Continued from page 693*)

rotating continually at a high speed. In this manner the paper is passed to the timing rollers a few moments before the printing stroke of the platen commences.

A 3" Sprocket Wheel, on the crank and camshaft at the driving end of the model, is connected by a long length of Sprocket Chain to a 1½" Sprocket Wheel 51 that is carried on a 6½" Rod together with four 1" Sprocket Wheels. These 1" Sprockets each carry one of the four feed chains, each of which passes over the Rods 52 and 53 and round the Rod 54. The Rod 53 consists of three separate pieces, two of which are Pole Pieces and the other a 3½" Rod. The Pole Pieces are carried at their outer ends on Corner Brackets and at their inner ends are fitted with Threaded Cranks. These Cranks carry guides built up from 5½" Flat Girders curved to the shape as shown in the illustration, and the 3½" Rod, mentioned previously, is then fitted in place. Two Collars on this 3½" Rod space the two inner chains apart the required distance.

One more movement remains to be fitted. This is the drive for the pick-up rollers 55 and 56, which are used for taking the sheets of paper from the impression roller and depositing them upon the delivery arm. These rollers are built up in an exactly similar manner to rollers 47 and 48, but it will be noticed that the lower rollers fit into spaces cut in the guide strips. The rubber tubing for the upper rollers is carried on Collars, but that for the lower rollers is fitted on Couplings. A ¾" Sprocket Wheel on one end of the shaft carrying the lower rollers is connected by Sprocket Chain to a similar Sprocket secured on the Rod 28 of the Electric Motor.

When the various movements have been synchronized the motors may be connected to their respective switches. One wire from the motor driving the fan is taken the full length of the model to a switch fitted on a 5½" × 3½" Flat Plate at the end of the model; the other wire is taken to a terminal on the same Plate as the switch. This Plate is shown clearly in the general view. One wire from the main driving motor is taken to a second switch on the Flat Plate and the other to one terminal of a Resistance Controller, the remaining terminal of the Controller being taken to the terminal carrying the wire from the fan motor. The controller will be found useful for finding the most efficient speed of the printing machine, and also for taking trial impressions while experimenting.

While any adjustments are being carried out, the Crank 34 should be in a horizontal position, thus preventing the impression roller from becoming covered with printing ink. It is also advisable to start the fan motor first in order that a good suction may be obtained before the machine is set in motion.

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Junior Section—(*Continued from page 711*)

stations and are practically equal to expresses on various sections. Here bogie coaches are the rule, and quite big tank engines. On a Hornby railway, therefore, bogie vehicles such as the Metropolitan Coaches may be used, arranged in sets if desired, with a composite coach at each end of the train. A point of interest is that the Metropolitan Railway operate a Pullman car on certain trains of this kind, and the same facilities are found on similar services in Scotland. Thus a Hornby No. 2 or No. 2 Special Pullman may be included in the make-up of one or two of the trains operated in miniature, and their use will give an interesting and distinctive appearance to the train. Another up-to-date feature is the buffet car service to and from Cambridge on the L.N.E.R., which may be reproduced on a Hornby layout by the use of an L.N.E.R. No. 2 Saloon.

As regards locomotive power, the Hornby No. 1 Special Tank may be used where more or less frequent stops are made, but for longer journeys, where fast running is required over certain sections, the No. 2 Special or No. 2 Electric Tank Locomotive is more appropriate. It is generally similar to the express tanks of most of our railways and, as one of our illustrations shows, a train of bogie coaches hauled by one of these engines has a typical and realistic appearance.

An obvious suggestion for suburban work is the use of the Metropolitan Train Sets. These are available for clockwork or electric lines, and interesting possibilities in connection with the latter were dealt with last month in the "*How to Get More Fun*" pages.

How to Get More Fun—(*Continued from page 707*)

the same as an English van. It is similar to an Open Wagon, but has curved supports extending upward, and over these a large wagon sheet is stretched and fastened forming a roof, and thus protecting from the weather any goods that may be carried in the truck. It is a more elaborate version of the ordinary English Open Wagon fitted with a Tarpaulin over the load.

A characteristic feature is the wine traffic that is handled on French systems, and to enable this to be dealt with satisfactorily special wagons are used. These take the form of a large cask or casks mounted on a wagon underframe, and both varieties are of course included in the Hornby Series. The single Wine Wagon has in addition a brakesman's compartment, but the double pattern is not so provided, but has an inspection ladder serving both casks. The appearance of a train of these on a miniature railway will arouse a great deal of interest, and the traffic is of such importance that it should not be neglected by owners of layouts that are operated as suggested in this article.

The French Brake Van is similar in build to the body portion of the Snow Plough, and is thus quite different from the vans that we are familiar with in England. As will be seen from one of our illustrations, a freight train made up of French type rolling stock has a very effective and interesting appearance, and no doubt readers who possess a number of these vehicles will give serious attention to this aspect of traffic working.

For Continental suburban services the No. 1 or other four-wheeled Pullmans may be used quite well. An interesting alternative which will give the impression of a French local train will be to employ the small American type Pullman type coaches included in the Hornby Series. A train of these coaches might be completed quite suitably by the American Caboose for this has several features in common with Continental stock, notably the raised lookout on the roof.

There are in addition the "Mitropa" Coaches both of No. 1 and No. 2 pattern, and their possibilities should not be neglected in connection with this subject.

Romance of Whaling—(*Continued from page 655*)

across the Polar region to China. He sailed up the East coast of Greenland, but meeting with the ice barrier he turned off and sailed east, skirted the edge of the ice to Spitzbergen, rounded Prince Charles' Foreland and continued northward until he reached Lat. 80° 23′. He named the most northerly point of Greenland reached "*Hold With Hope.*" There he saw many whales, and found his way blocked by the ice, and after convincing himself that there was no passage to the North in this part of the Arctic, he sailed south and arrived back in the Thames on 15th September the same year. Not only did Hudson establish a record by reaching 80° 23′, but his voyage opened up this region for whaling.

In 1611 the Muscovy Company, of London, under a patent from the Crown, sent the "*Mary Margaret*" to Spitzbergen to establish a whaling centre there. Six Basque harpooners accompanied the expedition as hunters and experts in making whale oil. A whale was killed and 12 tons of oil were obtained from it, but later the ship was wrecked, and the crew made their way in open boats to Bear Island. They were rescued by a vessel named "*Elizabeth,*" and returned to Spitzbergen. Later the "*Elizabeth*" came to an untimely end, and the crews of both vessels were taken on board the "*Hopewell*" of Hull and returned safely to this country. Undismayed by this misfortune the company sent out other ships during the years that followed, but bad management robbed the enterprise of success.

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HARRAP

A 480-Ton Gantry Crane—(*Cont. from page 659*)

specially suitable, but they suffer from the disadvantage of being unable to hoist a load to any great height, and this fact considerably restricts their usefulness. For instance, it is often necessary in ship repair and building work to raise a heavy load, such as a boiler or a turbine, high in the air and then swing it out over the ship and deposit it in the engine room. To do this it is sometimes necessary to lift the load to a sufficient height to clear the ship's funnel, a job that is easily carried out by a jib or a hammerhead crane.

In modified and smaller forms, however, gantry cranes are exceedingly useful, and are usually to be found in a modern engineering workshop. Here their sphere of activity is very wide, for they are able to pick up, carry and deposit loads at any point in the building. They prove their value best, however, under such conditions as are met with in warehouses, coaling yards and foundries, for they require little head room, work rapidly, and are handled easily. They frequently are to be seen travelling from end to end of the long warehouses that line quaysides and docks, and for this work it is usual to dispense with the end supporting pillars and ground rails, as these would occupy valuable ground space. Therefore the gantry is mounted on rails attached to and arranged parallel with the walls of the building, and placed high up near to the roof. This arrangement brings the whole of the floor space within range of the hoisting hook.

Although this type of gantry-crane is more popular numerically, a gantry mounted on pillar supports is preferable when it is desired to handle very heavy loads.

Gantry cranes are made in many different forms according to the conditions under which they have to work. A particularly interesting crane is at work in an American shipyard, In this case, instead of travelling on rails, the crane is mounted on a floating pontoon, so that it may be floated along a dock in order to handle loads on the quayside. It is also extensively employed in handling the huge baulks of timber used in building the slips for launching ships.

Sometimes the gantry is supported at one end only. This type is particularly suited for shipyard and quayside work, but is not suitable for dealing with heavy loads. In other cases the gantry is mounted on a single central supporting tower, and the tower itself is arranged to travel on rails laid along the top of a high steel structure. A 15-ton crane of this type is in use at the Mare Island Navy Yard, California. Each arm of the gantry reaches completely over two shipbuilding ways, and the crane travels on the runway the full length of the ways. The hoist trolley has a travel of 218 ft. from end to end of the gantry, and the height of the central supporting tower is 70 ft.

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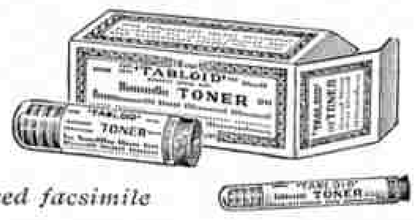

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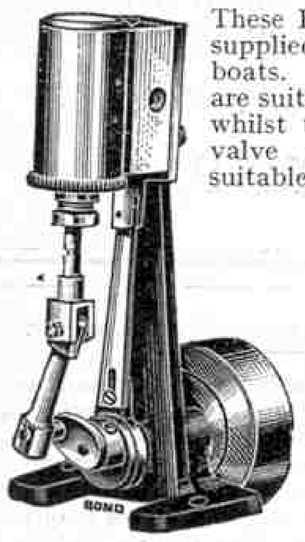

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Part No. 136a, Handrail Coupling, price 4d. This new part is designed to form a rigid joint between two standard Axle Rods set at right-angles to each other. The part is turned from solid brass and is provided with two Grub Screws by which Rods may be gripped. The chief use of the Handrail Coupling is in the assembly of handrails and railings of all kinds; it may also be employed as a gear lever knob, as a bearing for an Axle Rod, and for numerous ornamental purposes. Builders of "Simplicity" models will note that the part makes an excellent diver's helmet!

Part No. 136A

Part No. 179, Rod Socket, price 3d. This part is used in conjunction with the new Handrail Coupling No. 136a, as a support for the vertical member of the handrail. It will be found much neater for this purpose than a Double Arm Crank. The part consists of a turned brass boss provided with a screwed shank. A "blind" hole is cut in the boss so that an Axle Rod may be introduced. The boss is fitted with a Grub Screw and the screwed shank carries a standard Meccano Nut.

Part No. 179

In addition to its use in handrail assembly the Rod Socket may be employed as a "footstep" bearing for a vertical Rod; a Meccano Grease Cup should be fitted in the Grub Screw hole to provide adequate lubrication. It may be used also as a mercury-contact cup in electrical models.

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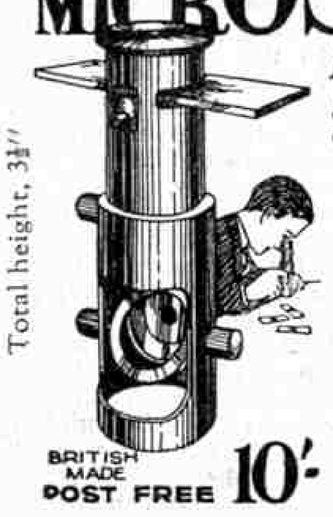

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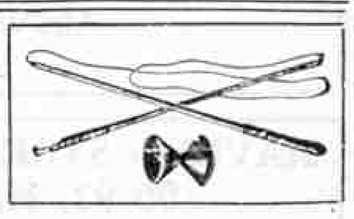

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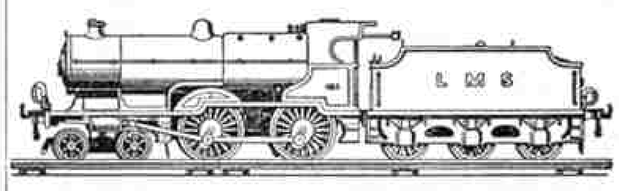

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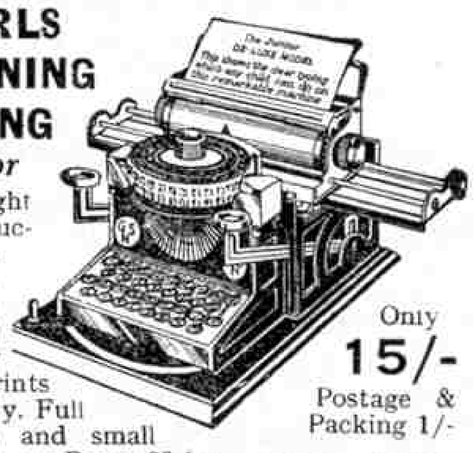

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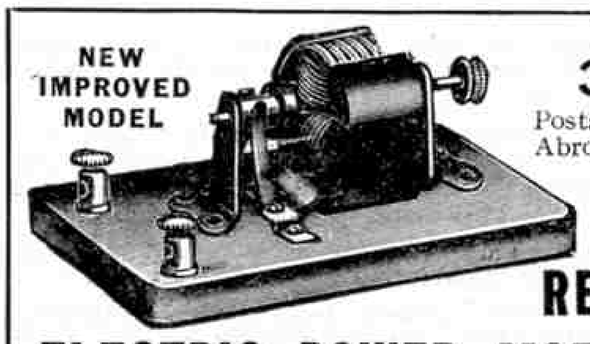

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OUR MAIL BAG

In this column the Editor replies to letters from his readers, from whom he is always pleased to hear. He receives hundreds of letters each day, but only those that deal with matters of general interest can be dealt with here.

Correspondents will help the Editor if they will write neatly in ink and on one side of the paper only.

T. W. C. Humphreys (Clerkenwell, E.C.1).—"For years I have been wanting to write, but until now have never had the courage to do so on account of my awful writing." Your writing is certainly not copperplate, Tom, but at least it has the merit of being legible, which is more than we can say about the writing of some of our correspondents! Now that you have "cast off the inferiority complex," as you put it, we hope to see your writing again very soon.

C. W. Mackie (Edinburgh).—"I have had a Meccano outfit for 12 years and I am now 23 years old, but I am more interested in Meccano now than ever I was." That is the unique feature about Meccano—the more you use it the more you realise its possibilities.

R. Buckley (Coonabarabran, N.S.W.).—"All my aunts, uncles and cousins, as well as my father, mother and grandmother, agree that the "*M.M.*" is the best boy's magazine printed." This is a splendid tribute, but with so many enthusiastic relatives we wonder that you ever get a chance to read your copy. We can picture you creeping stealthily away with it when you hear your grandmother coming!

L. T. Garrioch (Melbourne).—"The article on 'Electrical Engineering' in the 'What Shall I Be?' series came just at the right time for me and helped me to shape my plans for the future." We are delighted to hear this and to add your tribute to the many we have received in regard to the practical value of these articles.

J. E. Martin (Fishguard).—"I first had the "*M.M.*" given to me when I bought my first Meccano outfit somewhere about 1923. I enjoy it as much as ever, especially the aircraft section." Our correspondence shows that our aviation articles are rapidly growing in popularity, and indeed are becoming a serious rival to the railway pages! We may publish a book on aircraft later on.

D. M. Murray (Newlands, South Africa).—"I tried to do without the good old mag., which has been a friend since 1923, but have failed." Of course you have failed; what else could you expect! You will be interested to know that the aeronautical articles in the "*M.M.*" that you like so much have received high praise from many experts, including Sir Alan Cobham.

Mr. A. Hobart (Minneapolis, U.S.A.).—"Don't answer these questions if I am pestering you. I bet I am." You lose your bet! We are always glad to answer queries from readers. We don't mind criticism a bit; many of the most popular features of the "*M.M.*" to-day have been developed from readers' suggestions.

T. H. Roberts (Lincoln).—We are glad to hear of your enthusiasm for your Meccano Aeroplane Constructor Outfit. In future issues of the "*M.M.*" we shall announce competitions for owners of these outfits, and also of Motor Car Constructor Outfits.

N. S. Paul (Kingston-on-Thames).—We were exceedingly interested to hear that the comments on "Safety First" in the June Editorial finally decided you to take up a profession in which, as you say, "ability counts more than seniority." We are sure you will not regret your choice, and we should be glad to hear of your progress.

G. Brown (Belfast).—"I like the 'Simplicity' Contests because it is such fun building up a model and then reducing it part by part to the utmost limits." The extraordinary popularity of these contests shows that this simplifying business appeals to thousands of readers, and we shall announce more contests shortly.

C. Weston (Auckland, N.Z.).—We are sorry you have hesitated so long to send contributions for the Readers' Pages. We have stated many times that we will do any "tinkering up" that may be necessary.

Stop Press

Owing to the keen topical interest in "*Miss England III*" and in the greatly increased railway speeds on the L.M.S.R. we have decided to include articles on these subjects that have reached us as we go to press. At the last moment, therefore, it has been found necessary to omit two of our regular features, "*The Life Story of Meccano*" and "*What Shall I Be?*" These will be resumed next month.

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Sale. Model Farm. 220 pieces. 25/– or nearest offer. Stamp for list.—Upson, Marlesford, Woodbridge, Suffolk.

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To Contributors. The Editor will consider articles and photographs of general interest and payment will be made for those published. Whilst every care will be taken of articles, etc., submitted, the Editor cannot accept responsibility for any loss or damage. A stamped addressed envelope of the requisite size should be sent where the contribution is to be returned if unacceptable.

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Readers Overseas and in foreign countries may order the "*Meccano Magazine*" from regular Meccano dealers or direct from this office. The price and subscription rates are as above, except in the cases of Australia, where the price is 1/5 per copy (postage extra), and the subscription rates 9/6 for six months and 19/– for 12 months (post free); Canada, where the price is 15c. per copy, and the subscription rates 75c. for six months, and $1.50 for 12 months (post paid).

The U.S.A. price is 15c. per copy, and the subscription rates $1 and $2 for 6 and 12 months respectively (post free).

Overseas readers are reminded that the prices shown throughout the "*M.M.*" are those relating to the United Kingdom and Northern Ireland. Current Overseas Price Lists of Meccano Products will be mailed free on request to any of the undermentioned agencies. Prices of other goods advertised may be obtained direct from the firms concerned.

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NEW ZEALAND: Models Ltd., P.O. Box 129, Paykel's Building, Anzac Avenue, Auckland.

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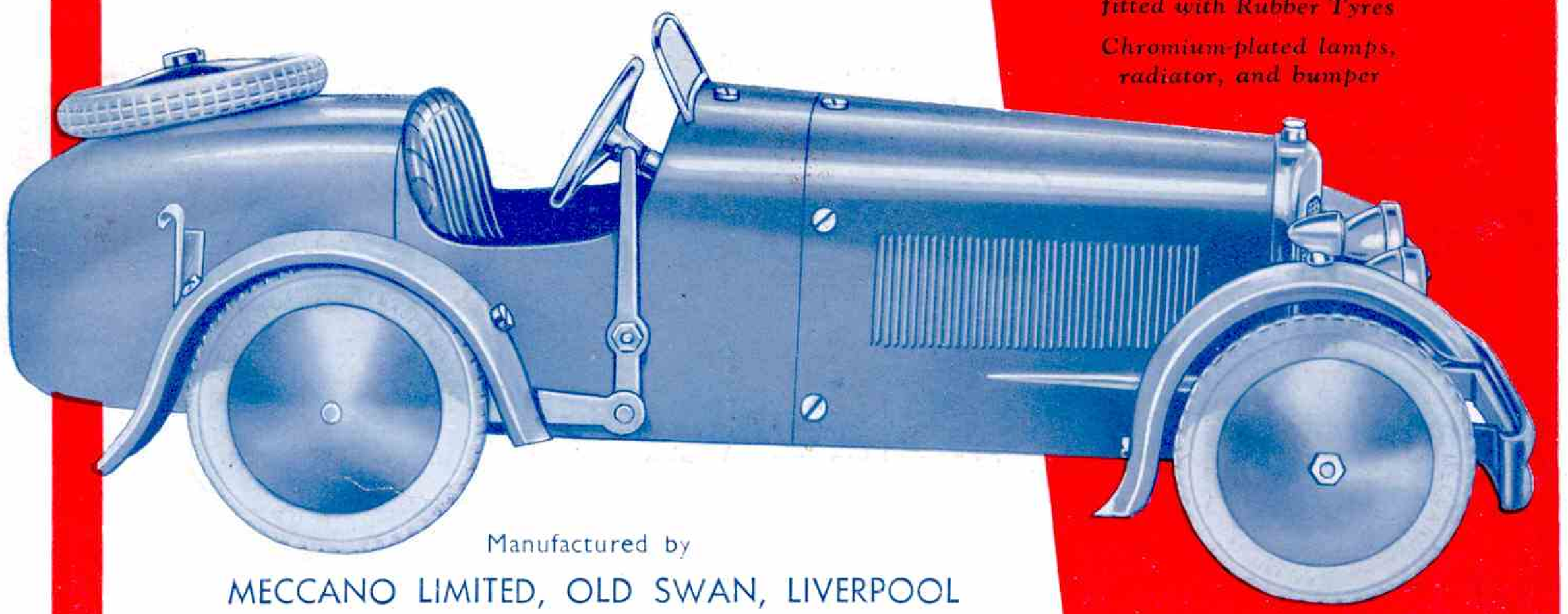

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